

State of the Fireflies of the United States and Canada:

DISTRIBUTIONS, THREATS, AND CONSERVATION RECOMMENDATIONS

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Photographs

We are grateful to the many photographers and designers for allowing us to use their wonderful photographs. The copyright for all photographs is retained by the creators. None of the photographs may be reproduced without permission from the creator. Cover photographs: FRONT—A firefly rests on a blade of grass by day; BACK—fireflies flash above lupines in a wildflower meadow. (Photographs by Radim Schreiber / fireflyexperience.org [front] and Mike Lewinski / Flickr [back].)

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Acronyms & Abbreviations

ACRONYM

ALAN

BLM

CR

DD

EN

EOO

ESA

EW

EX

GBIF

IUCN

LC

NT

SCAN

SGCN

SSC

SWAPs

SWG

US ESA

USFS

USFWS

VU

MEANING

Artificial light at night

Bureau of Land Management

Critically Endangered

Data Deficient

Endangered

Extent of Occurrence

Endangered Species Act

Extinct in the Wild

Extinct

Global Biodiversity Information Facility

International Union for Conservation of Nature

Least Concern

Near Threatened

Symbiota Collections of Arthropods Network

Species of Greatest Conservation Need

Species Survival Commission

State Wildlife Action Plans

State Wildlife Grants

U.S. Endangered Species Act

U.S. Forest Service

U.S. Fish and Wildlife Service

Vulnerable

Southwest synchronous fireflies (*Photinus knulli*) light up the evening sky along a creek in Arizona. (Photo: Scott Cylwik.)



Anecdotal reports of firefly declines have been on the rise in recent decades. While population declines have been documented for some species in Europe and Asia, the picture was not as clear in North America. With the exception of a few localized studies, no effort had previously been made to assess the conservation status of the 171 described taxa in the United States and Canada. In order to understand the extinction risk of fireflies in this region, researchers and firefly experts with the Xerces Society, Albuquerque BioPark, Tufts University, and the International Union for Conservation of Nature (IUCN) Species Survival Commission (SSC) Firefly Specialist Group completed Red List assessments for 130 firefly species and two subspecies (77% of described taxa in this region to date). These are the first such assessments conducted for fireflies globally.

This report summarizes the extinction risk and conservation status of these species, highlights major threats, and offers an action plan for protecting fireflies. It includes species profiles for all 18 taxa **threatened with extinction** and two Near Threatened species in the United States and Canada and provides state- and province-specific species lists and resources to promote conservation action. It is our hope that this report can help guide future firefly research and conservation programs in the region, serve as a model for other regions, and act as a catalyst for conservationists, research scientists, and policy makers to develop strategic plans and prioritize funding to ensure the wellbeing and longevity of our native firefly fauna.

Key Messages

- » The US and Canada are home to 171 described firefly taxa representing 20 different genera.
- » Recent IUCN Red List assessments of 132 of these taxa has revealed that 14% are **threatened with extinction**, 2% are categorized as Near Threatened (NT), and 32% are Least Concern (LC), though this may be an underestimate of actual extinction risk, since over half (53%) of the species assessed lack the information needed to evaluate their extinction risk and are categorized as Data Deficient (DD). Assuming that DD species are threatened at the same proportion as other assessed species, it is reasonable to expect that many of these species will be categorized as **threatened** as additional information becomes available.

Threatened with Extinction

Note that the use of the word **'threatened'** throughout this report refers to species categorized as Critically Endangered, Endangered, or Vulnerable on the IUCN Red List. It does not indicate a federal listing status under the US Endangered Species Act.

What Are Dark Sky Initiatives?

Dark sky initiatives are part of a global movement to reduce light pollution by eliminating or restricting artificial light at night.

Some of the most common initiatives include promoting the use of lighting fixtures that direct light only where it is needed, campaigning for communities to adopt lighting regulations, and encouraging friends and neighbors to turn off unnecessary outdoor lighting after dark.

Light pollution is a significant threat to many species of fireflies around the world. (Photo: José Ángel / flickr.)





Increased survey and monitoring efforts are urgently needed for many firefly species, especially those that are categorized as threatened or Data Deficient. (Photo: Dan Perlman.)

- » Primary drivers of decline include habitat loss and degradation, light pollution, and climate change, highlighting the need for habitat restoration, greater implementation of Dark Sky initiatives, and identification and protection of high-quality habitats that may increase species resiliency under predicted climate change scenarios.
 - » There is an urgent need for more surveys, monitoring, and field studies, particularly for **threatened** and DD species.
 - » Land managers, policymakers, scientists, and the public can play major roles in firefly conservation by protecting fireflies and their habitats, conducting basic research, restoring degraded sites, completing inventories, monitoring populations, and expanding education and outreach efforts.
- » Some of the key barriers to firefly conservation include inadequate data and limited funding. Adding species to state and federal lists, prioritizing funding for species monitoring and conservation at federal, state, and local levels, and encouraging students and community scientists to contribute to firefly research projects can help alleviate some of these challenges.

Introduction

There are few insects that inspire such warm feelings of nostalgia as fireflies. Whether you were lucky enough to grow up with flashing fireflies or have only dreamt of seeing them as an adult, it is still quite likely you live amongst them. Although flashing fireflies receive a lot of attention, there are actually two other types of fireflies that are less well known: daytime dark fireflies and glowworms. Representatives of all three groups can be found all around the world. Some of these, such as the *Pteroptyx* congregating synchronous fireflies found in Southeast Asia, are fairly well studied (e.g., Jusoh et al. 2018; Sartsanga, Swatdipong, and Sriboonlert 2018; Jaikla et al. 2020). Others, including the *Microphotus* glow-worms of the southwestern US, are relatively unknown. A few, like the common European glow-worm (*Lampyrus noctiluca*), are known to be in decline (Gardiner and Didham 2020). Fireflies around the world are threatened by habitat loss, light pollution, and pesticide use (Lewis et al. 2020). That they may be declining does not come as a huge surprise in this era of global insect declines (e.g. Wagner et al. 2021). And yet, although anecdotal reports are on the rise, only a few studies have been published that support these claims (Khoo et al. 2009; Atkins and Bell 2016; Gardiner and Didham 2020). In North America, the state of fireflies was even murkier. Until very recently, no comprehensive studies had been conducted to assess the state of this region's firefly populations.

In 2021, researchers with the Xerces Society, Albuquerque BioPark, and International Union for the Conservation of Nature (IUCN) Species Survival Commission (SSC) Firefly Specialist Group completed Red List assessments for 132 species and subspecies of North American fireflies, representing 79% of the known firefly fauna in the United States and Canada at the time (Fallon et al. 2021). This report is meant to be used as a companion to this paper and the individual assessments published on the [IUCN Red List](#). Here, we summarize the results of the assessments, provide more details about specific threats, map out geographic areas of conservation concern, and profile individual species that are **threatened with extinction** or nearly threatened by extinction. We also identify major data gaps, review existing conservation measures for fireflies, and provide additional recommendations for their protection. Our goal is to present the current state of knowledge regarding the conservation status of fireflies in this region, with the hope that this information can help guide future management and conservation actions. In the following pages, you will find:

- A species checklist and corresponding Red List categories of fireflies in the US and Canada
- Maps depicting species richness and areas of high endemism or numbers of **threatened** species
- A summary of the main threats affecting fireflies in the US and Canada
- Recommendations for priority research and conservation actions
- Species profiles for all 20 **threatened** and nearly threatened species
- A list of species of conservation concern, organized by US state and Canadian province

Endemism is the state of a species being restricted to a single geographic area, whether that be a county, state, country, or other delineated zone. Such species are referred to as endemic species.

2

Firefly Distribution and Natural History

Figure 1—New firefly species are being discovered to this day, with over 40 new species described from the US and Canada in just the last decade.

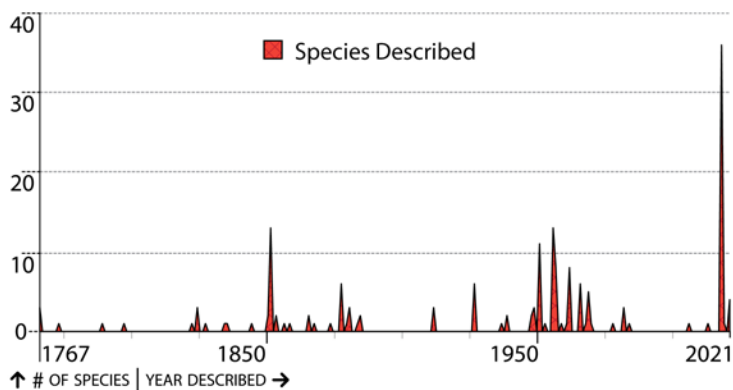
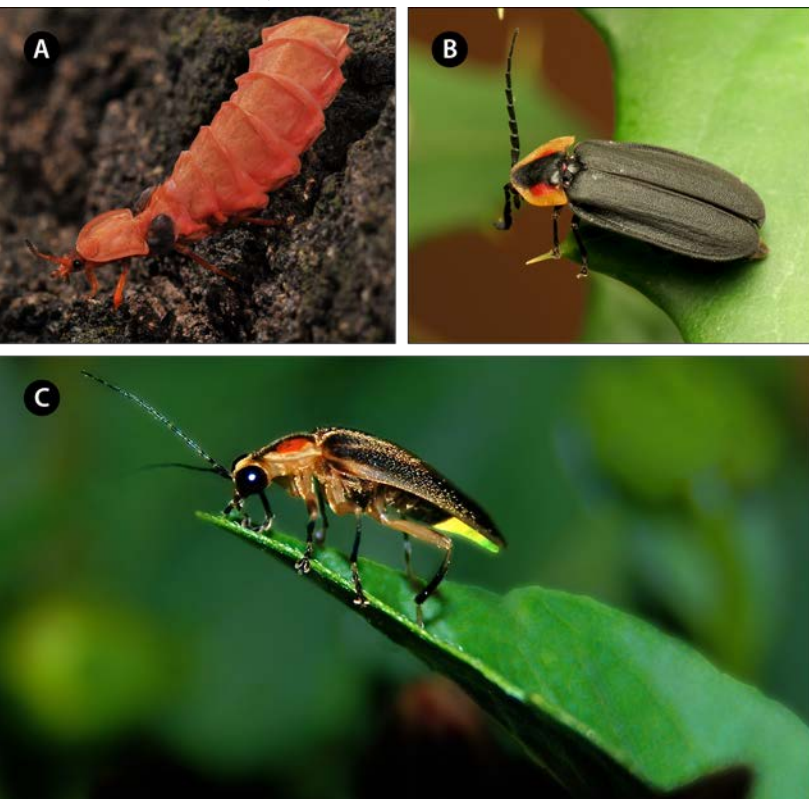


Figure 2—Representatives of the three firefly types shown below: *Pleotomus nigripennis* adult female glow-worm (A), a *Lucidota atra* daytime dark firefly (B), and a *Photuris* flashing firefly (C). (Photos: Alex Yelich [A]; Katja Schulz / Flickr [B]; Warren Lynn / Flickr [C].)



Fireflies are members of the incredibly diverse beetle order Coleoptera. Also known as lightning bugs and glow-worms, they belong to the firefly family, Lampyridae. Over 2,200 species from 110 genera have been described globally, from every continent except Antarctica (Slipinski, Leschen, and Lawrence 2011).

The greatest species diversity is found in the Neotropical and Indomalayan regions of the world (Branham 2010; Lewis 2016). While species diversity is not as high in the US and Canada, these two countries are still home to 171 described taxa from 20 genera (Appendix A). New species are being described every year; in the US and Canada, species descriptions have increased slowly yet steadily over time, with the largest jump occurring in 2018 with the publication of 36 new *Photuris* species descriptions (Lloyd 2018; Figure 1).

Fireflies can be organized into three different groups based on their courtship behavior (Figure 2):

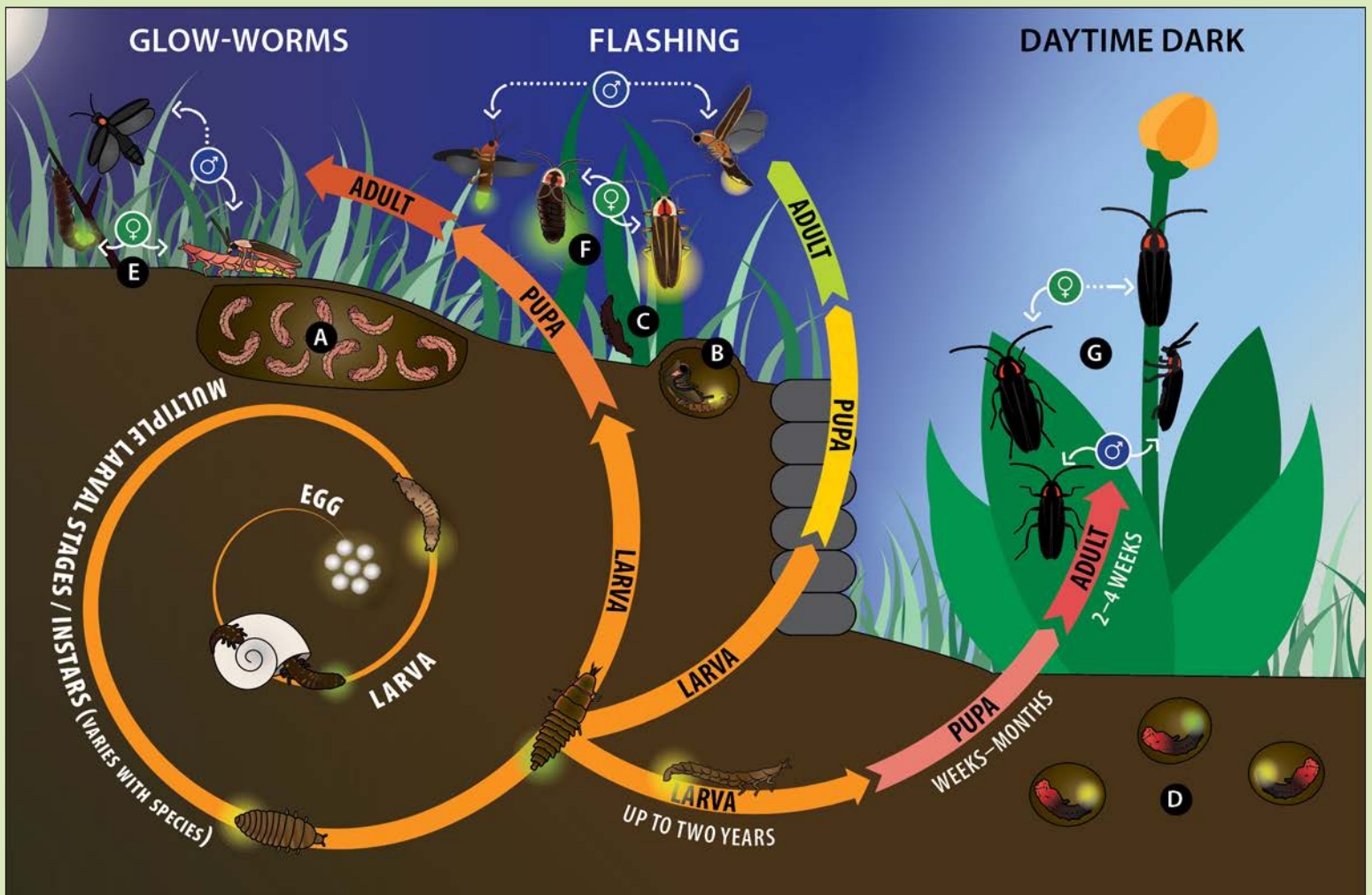
1. **Flashing fireflies**, which are the most-commonly-known fireflies, are nocturnal or crepuscular and employ bioluminescent courtship signals—typically a series of quick flashes—to communicate with potential mates.
2. **Glow-worms** also use bioluminescence and are active at dusk and after dark; in this group, flightless females emit long-lasting glows to attract mostly non-luminescent males.
3. **Daytime dark fireflies** are diurnally active and do not light up as adults; instead, they rely on chemical cues known as pheromones to find mates.

Despite these differences in the use of bioluminescence in adults, all three groups of fireflies emit light as larvae to communicate that they are distasteful, thereby avoiding predation.

Just like other beetles, fireflies undergo complete metamorphosis with four distinct life stages: egg, larva, pupa, and adult (Figure 3). Generation times can vary dramatically depending on the species, latitude, elevation, and climate; but, in general, fireflies spend most of their lives as larvae. A firefly will typically take two to three weeks to hatch from an egg, after which it will undergo multiple instars as it eats and grows. Up to two years after hatching, the larva will shed its final larval skin and become a pupa. Another couple weeks later, it will emerge as an adult which will then live for about three weeks (Faust 2010; Lewis 2016; Figure 3).

Fireflies can be found in diverse habitats, from open fields and wetlands to dense forests and desert canyons. The key element in all firefly habitats is moisture, which is critically needed at all life stages to prevent desiccation. Within these larger habitats, microhabitats such as small burrows, vegetation, rotting logs, and leaf litter are very important to fireflies, offering shelter, places to perch and signal, overwintering habitat, hunting grounds, and more.

Figure 3—Fireflies spend most of their lives in the larval stage. After approximately two years as larvae, some species pupate together (A) or alone (B) in shallow cavities at or slightly above soil level, aboveground on vegetation (C), or in shallow chambers an inch or two belowground (D). Flightless adult females (♀) are found in all three groups, varying from wingless (E) to different levels of short-winged (F), a.k.a. brachypterous, the most extreme of which are functionally wingless. While all three groups are bioluminescent as larvae and pupae, not all adults have functioning light organs, a.k.a. lanterns. Daytime dark fireflies and many adult male (♂) glow-worms do not produce light; in both groups the females may signal/ attract males using light (glow-worms) or pheromones (G).



3

Assessment Methodology

Prior to beginning the species assessments, we developed a checklist of all native described Lampyridae species in the US and Canada by starting with the list compiled by Lloyd (2003) and updating it to include recent species descriptions (Cicero 2006; Heckscher 2013; Lloyd 2018; Faust and Davis 2019). This list was vetted for relevant taxonomic updates (Cicero 2013; ITIS 2020), which resulted in a final checklist of 165 species and two subspecies ([Appendix A](#)). We then removed 35 recently described species (Lloyd 2018) for which data and species experts were lacking. Four additional species, described after our assessments were completed (Heckscher 2021), were also not included. This left us with 130 species and two subspecies to include in our assessment.

Data on species distributions, taxonomy, life history, and threats were compiled from the peer-reviewed and gray literature, digitized museum records, community science initiatives, and through consultation with species experts. Species occurrence records were compiled for each species and vetted to reduce potential errors in distribution. These records were used to create species range maps and, when possible, calculate each species' extent of occurrence (EOO) and area of occurrence (AOO).

Each species was then assessed against five IUCN Red List criteria with quantitative thresholds, which are based on standard biological indicators that render populations more vulnerable to extinction (IUCN 2012):

- A—past, present, or future population size reduction;
- B—geographical range size with evidence of decline, fragmentation, or fluctuation;
- C—small population size with decline, fragmentation, or fluctuation;
- D—very small or restricted population; and
- E—quantitative analysis of extinction risk.

Based on the results, each species was assigned to one of the Red List categories: Extinct (EX), Extinct in the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), Least Concern (LC) or Data Deficient (DD).

The Red List assessments then underwent review by a panel of species experts; 128 were published on the IUCN Red List in March 2021 (IUCN 2021), while the remaining four await publication. A more detailed description of the methodology is available in Fallon et al. 2021.

Understanding IUCN Red List Rankings

The IUCN Red List is a barometer of the health of the world's biodiversity. It uses a series of criteria to assess the extinction risk of thousands of species, thus providing a global inventory of species statuses that can be used to inform research, policy, and on-the-ground conservation efforts, among other uses.

The table below is a simplification of the rankings, and includes only the main criteria; there are subcriteria that also must be met. See [References](#) for more information.

RANK	POPULATION REDUCTION RATE	GEOGRAPHIC RANGE		POPULATION		EXTINCTION PROBABILITY ³
		EEO ¹	AAO ²	SIZE	RESTRICTIONS	
Least Concern	A species that has a widespread and abundant population					
Near Threatened	A species that is likely to qualify for a threatened category in the near future					
Vulnerable Species	30–50% population decline	<20,000 km ²	<2,000 km ²	<10,000 mature individuals	<1,000 mature individuals or an AAO of <20 km ²	at least 10% within 100 years
Endangered Species	50–70% population decline	<5,000 km ²	<500 km ²	<2,500 mature individuals	<250 mature individuals	at least 20% within 20 years or 5 generations
Critically Endangered	≥80–90% population decline	<100 km ²	<10 km ²	<250 mature individuals	<10 mature individuals	at least 50% within 10 years or 3 generations
Extinct in the Wild	Only survives in cultivation (plants), in captivity (animals), or as a population well outside its established range					
Extinct	No remaining individuals of the species					

1. Extent of Occurrence
2. Area of Occurrence
3. In the wild

All of the species assessed as threatened were done so under Criterion B, which examines geographical range size and evidence of decline in number of individuals, localities, or habitat, among other subcriteria. For example, both subspecies of the Southwest spring firefly are categorized as threatened due to their limited ranges in Arizona and documented or suspected declines in habitat. Shown below: Southwest spring fireflies flash along a fence line. Cattle grazing is a documented threat to this species and its habitat. (Photo: Scott Cylwik.)



4

Assessment Results

Extinction Risk and Conservation Status

Eighteen species were found to be **threatened with extinction** (Critically Endangered [CR], Endangered [EN], or Vulnerable [VU]) in the US and Canada (Table 1). Since we lacked population data for these species, they were all assessed as **threatened** under Criterion B, which is based on restricted ranges with evidence of decline, fragmentation, or fluctuation. Seven of these **threatened** species are endemic to a single state or province ([Appendix A](#)). An additional two species are listed as Near Threatened (NT), 42 as Least Concern (LC), and 70 as Data Deficient (DD) (see Table 1).

Species Threatened with Extinction

Species categorized as CR, EN, or VU are considered **threatened** because they are facing extremely high, very high, or high risk of extinction in the wild, respectively (IUCN 2012). Using the Red List criteria, we found that 14% of species (18 species total) are **threatened with extinction**. However, this must be considered a low estimate in light of the large number of DD species. If we were to assume that all DD species were also threatened, the percentage would rise to 67% (CR + EN + VU + DD); taking a mid-estimate approach, in which we assume that the same proportion of DD species are threatened as we found in the non-DD species, 29% of species may be **threatened with extinction** (Table 2). Profiles for each threatened species are available in [Appendix B](#).

Table 1. Summary of the Red List Status of Fireflies in the US and Canada.

	IUCN RED LIST CATEGORY	# (%) OF SPP.
THREATENED WITH EXTINCTION	Extinct	0
	Extinct in the Wild	0
	Critically Endangered (CR)	1 (1%)
	Endangered (EN)	10 (8%)
	Vulnerable (VU)	7 (5%)
	Near Threatened (NT)	2 (2%)
	Least Concern (LC)	42 (32%)
	Data Deficient (DD)	70 (53%)
	TOTAL SPECIES ASSESSED	132

Table 2. Number and Percentage of Firefly Species Threatened with Extinction in the US and Canada.

Table extracted from Fallon et al. 2021 under a Creative Commons license.

Total Threatened		#	%
LOWER BOUND	CR + EN + VU	18	14%
BEST (MID) ESTIMATE	$(CR + EN + VU) \div (total - DD) \times total^*$	38	29%
UPPER BOUND	CR + EN + VU + DD	88	67%

(*n=132)

Near Threatened Species

Two species were assessed as Near Threatened (NT), which means they are close to qualifying for a **threatened** category and could do so in the near future if not monitored and addressed by appropriate management actions. Profiles for both species are available in [Appendix B](#).

Least Concern Species

Approximately one third (32%) of species assessed are listed as Least Concern (LC). These species are not considered to be under any known major range wide threat that would lead to their extinction now or in the near future. Many of these species are common and/ or widespread, making it unlikely that their entire population would be wiped out from any single threatening event. However, largescale population monitoring of fireflies—including species listed as LC—is not occurring; so, if declines in their populations are occurring, they are most certainly going undetected. Indeed, declines in other widespread and formerly common invertebrates that are better studied have been found (summarized in Forister et al. 2019).

Despite the LC categorization, some of these firefly species may still benefit from conservation and management efforts. For example, all the species that are currently considered highly attractive for firefly tourism (e.g., synchronous fireflies [*Photinus carolinus*] and blue ghosts [*Phausis reticulata*]) have been listed as LC, yet there is increasing concern from the conservation community about protecting these species as firefly tourism grows in popularity.

Data Deficient Species

The majority of species assessed (70 total, or 53%), were categorized as Data Deficient (DD). This means that not enough information was available to accurately assess their extinction risk, often due to a lack of research or a poorly understood geographic distribution. The high number of DD species highlights the need for targeted surveys and life history research. It is very likely that some of these DD species are **threatened with extinction**, yet we do not currently have enough data to clearly support any extinction risk categorization. Because all the species assessed as **threatened** were done so using Criterion B (geographical range size with evidence of decline, fragmentation, or fluctuation), DD species with documented threats but for which very little information on geographic distribution is available may also be threatened. In addition, some species, such as those in the diurnal firefly genus *Ellychnia*, were categorized as DD in part due to taxonomic uncertainty. DD species that are thought to be of high conservation concern are included in the state and province species lists in [Appendix C](#).

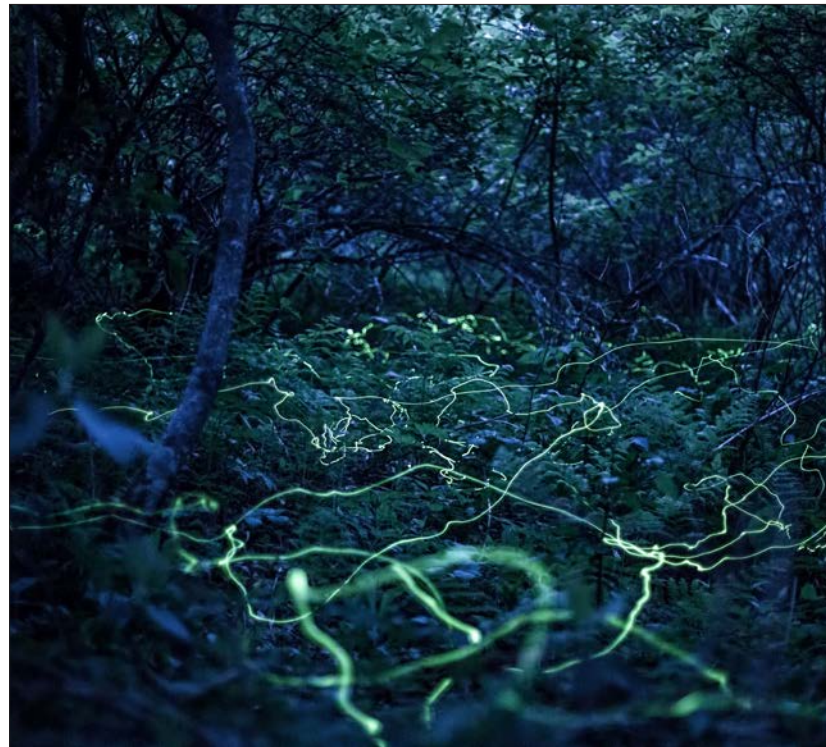


Figure 4—Even highly attractive species like blue ghost fireflies could be considered at-risk in the future, depending on the effects of tourism on their habitat in addition to other factors. (Photo: Radim Schreiber.)

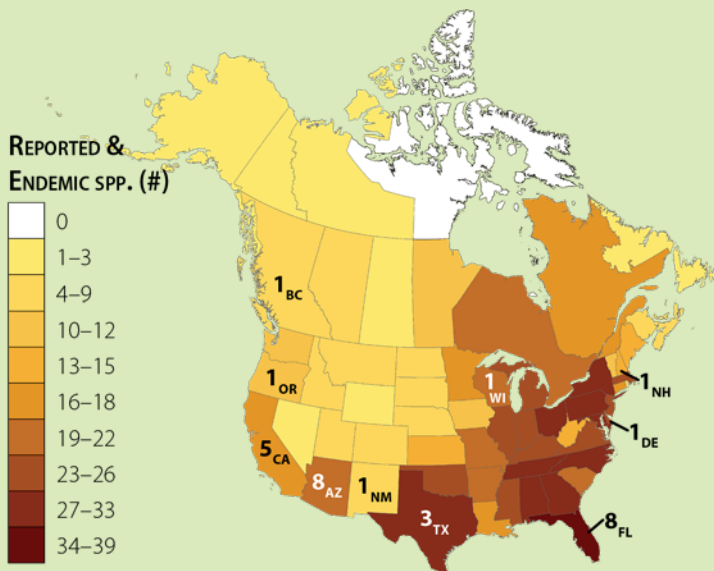


Figure 5—Geographic variation in firefly species richness with the number of endemic firefly species by state and province.*

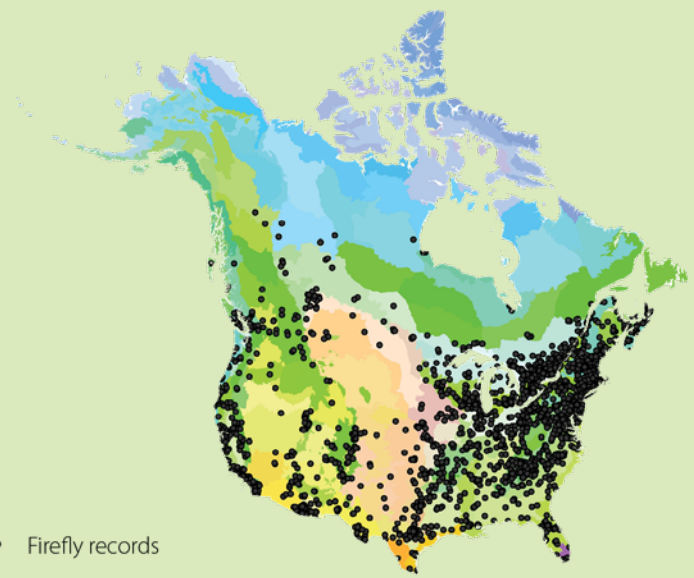


Figure 6—Firefly (family Lampryidae) distributions by Level III Ecoregion.

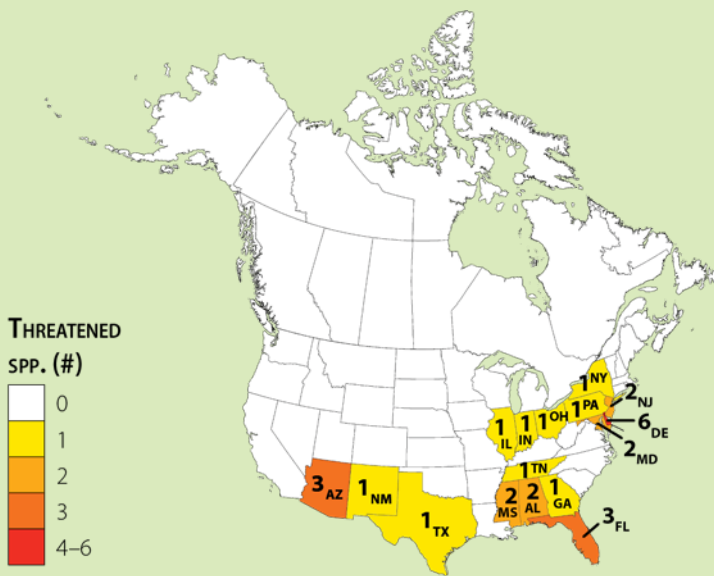


Figure 7—Number of threatened species occurring by state or province†.

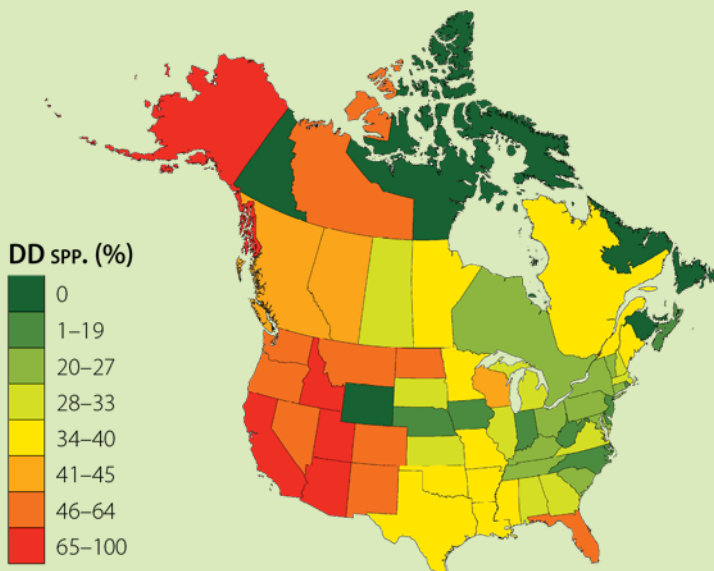


Figure 8—Data Deficient (DD) species by state and province, reported as a percent of total species†.

Spatial Distribution of Firefly Species

Fireflies have been documented in every US state except Hawaii and all Canadian provinces except for Nunavut (Figure 5[†]). Twenty-nine species (22%) are thought to be endemic to a single state or province, with the highest rates of endemism found in Florida and Arizona (eight species each; Figure 5). The ecoregions with the highest species richness (defined here as more than 30 reported species) are the North Central Appalachians, Northern Allegheny Plateau, Northern Piedmont, Blue Ridge, Middle Atlantic Coastal Plain, and Southeastern Plains ecoregions (Figure 6).

Threatened firefly species ($n=18$) are found primarily in the eastern and southwestern US; Florida is home to five **threatened** species, while six can be found in the small state of Delaware (Figure 7[†]). DD species ($n=70$), when reported as a percentage of total species for each state, occur in greater numbers in western states (Figure 8[†]). This map highlights areas where more research and surveys are needed understand firefly distributions, population size, trends, and conservation statuses.

* Note that this map (Figure 5) does not include 35 newly described *Photuris* species by Lloyd (2018).

† Figure adapted from Fallon et al. 2021 under a Creative Commons license.

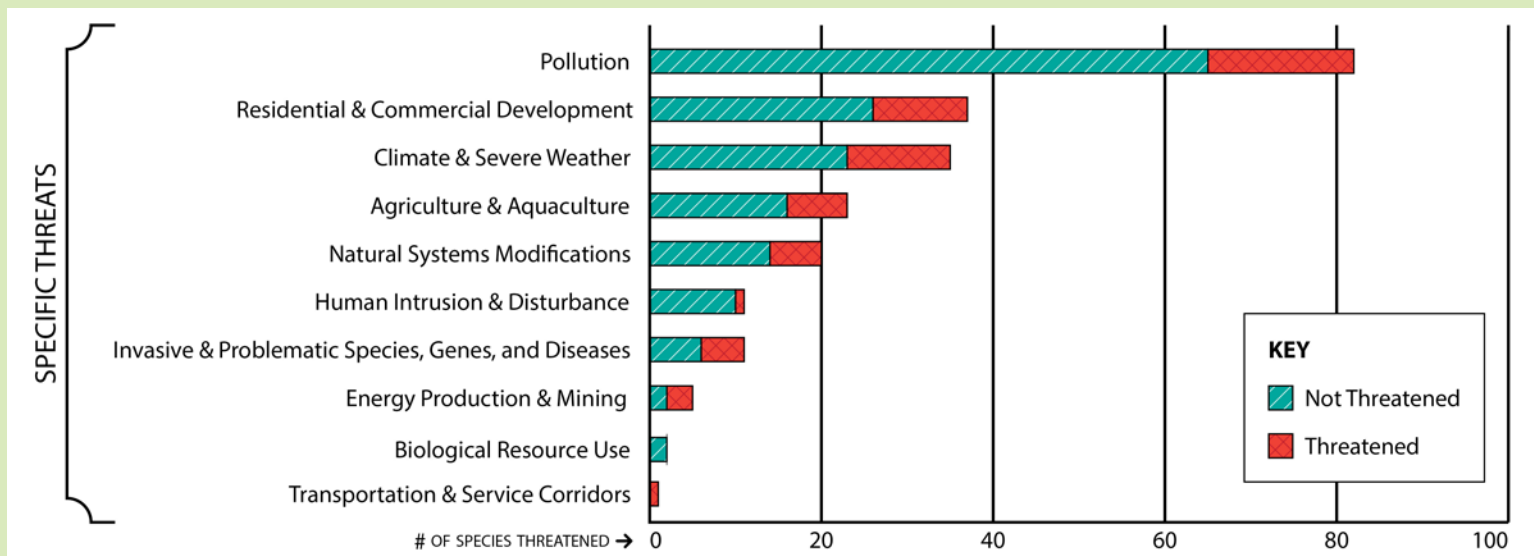


Figure 9—Summary of threats to 88 species of fireflies in the US and Canada, based on IUCN Red List threat categories.

Major Threats to Fireflies in the US and Canada

For species with sufficient information to identify known and suspected threats to their persistence (88 species total), the greatest threats included pollution (primarily light pollution), residential and commercial development, and climate and severe weather (Figure 9). Notably, many of the other threat categories denote some type of habitat loss, modification, or degradation; if combined into a single category of “habitat loss and degradation,” this would vie with pollution for greatest known threat.

Habitat loss has been identified as the single greatest perceived threat to fireflies worldwide (Lewis et al. 2020). Because so many North American firefly species are habitat specialists, including all 18 **threatened** species, this is particularly troubling. Habitat loss can take many forms, from residential and commercial development to modification of waterways and agricultural conversion. Except for large, strong fliers like the *Photuris* spp., most fireflies are thought to be poor dispersers, making it difficult for them to leave a site and colonize new ones. This is especially true for glow-worms, which have flightless adult females (Figure 10). Larvae are also not known to move far beyond their natal habitat. And because both larvae and adult females are active primarily at ground level, they are also much more susceptible to ground disturbances such as mowing, tilling, heavy machinery use, and trampling from cattle or people.

Habitat degradation is closely tied to habitat loss. One source of degradation—light pollution—is increasingly a major concern for fireflies and other nocturnal wildlife (Owens and Lewis 2018; Owens et al. 2020). Artificial light at night (ALAN) has been shown to disrupt the

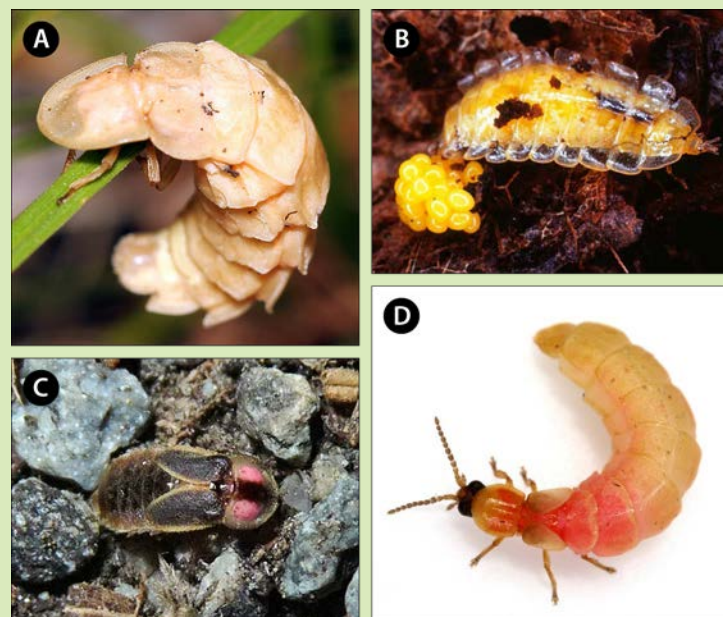


Figure 10—In addition to being flightless as larvae, the adult females of many firefly species are flightless, limiting their ability to disperse. ABOVE—flightless adult female fireflies: pale glow-worm (*Pleotomus pallens* [A]); *Phausis* with eggs (B); pine barrens firefly (*Photinus scintillans* [C]); starry firefly (*Ph. stellaris* [D]). (Photos: Joe Lapp / BugGuide [A]; James E. Lloyd / University of Florida [B]; Diane P. Brooks / iNaturalist [C]; Mike Quinn / BugGuide [D].)

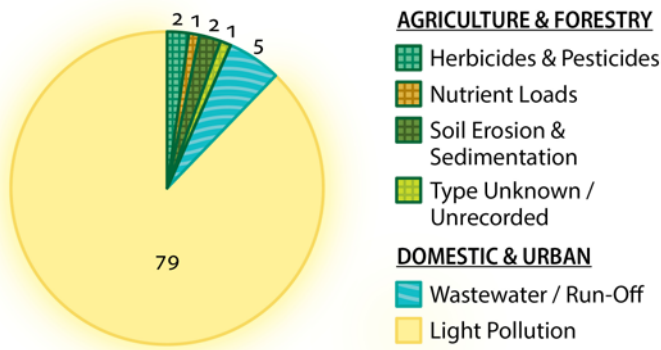


Figure 11—Number of species threatened by pollution, with a breakdown by specific threat.

bioluminescent courtship signals used by fireflies; it can also interfere with larval dispersal (Owens and Lewis 2021a; 2021b). If fireflies cannot communicate, it becomes more difficult to find a mate; this of course can have cascading impacts on reproductive fitness and the longevity of a population. Over 75% of firefly species in the US and Canada use these courtship signals, highlighting the severity of this threat. In our assessments, light pollution was identified as a threat to 79 firefly species (Figure 11).

Although not identified as a major threat to fireflies in the US and Canada, pesticide use (Figure 11) can also degrade habitat and potentially lead to direct mortality of fireflies or their prey. Insecticides such as neonicotinoids are particularly concerning due to their widespread use and persistence in the landscape; this class of insecticides has been connected to declines in other insects like bees (Gill, Ramos-Rodriguez, and Raine 2012; Baron et al. 2017; DiBartolomeis et al. 2019). Given the relatively few studies examining the effects of pesticides on fireflies, and the fact that pesticide use was perceived as a major threat to fireflies globally (Lewis et al. 2020), it is likely that pesticides play a larger role in firefly declines in this region than is currently documented.

Climate change and related severe weather events are also threatening firefly populations. Warming global temperatures are leading to rising sea levels and more frequent and severe storms, as well as drought. Because moisture is so important to fireflies, drought can be particularly devastating to species that occur in the arid West. In coastal areas, rising sea levels and severe storms like hurricanes can destroy firefly habitats and lead to direct mortality.

Existing Conservation Measures

There are few existing conservation measures in place for fireflies. The Bethany Beach firefly (*Photuris bethaniensis*), which was categorized as CR on the IUCN Red List, is listed as State Endangered in Delaware. This firefly was petitioned for US Endangered Species Act (US ESA) listing in 2020 and received a positive 90-day finding (USFWS 2021). It is now awaiting a Species Status Assessment by the U.S. Fish and Wildlife Service (USFWS) to determine its fate. No other firefly species are legally protected or petitioned at the federal or state level.

Several species are identified as imperiled in state and regional lists, including those maintained by state heritage programs, state wildlife agencies, and NatureServe. In addition, at least four states (Florida, South Carolina, Delaware, Maryland) currently include some fireflies as Species of Greatest Conservation Need (SGCN) in their State Wildlife Action Plans (SWAPs), and many others plan to add threatened and at-risk firefly species in their upcoming 10-year SWAP updates. Including species in SWAPs can spur conservation action; in 2000, Congress created the State Wildlife Grant (SWG) Program, which distributes funding to states for the conservation and management of nongame species. Species that are listed as SGCN are considered high priority, particularly when few to no other funding mechanisms exist.

Moving Forward: Taking Action for Fireflies

These assessments have made it clear that additional research and conservation efforts are needed to protect fireflies in the US and Canada. Nearly all **threatened** and Data Deficient (DD) species had the same recommended conservation actions: surveys and monitoring, habitat protection, and basic life history research (Fallon et al. 2021). In the following sections, we recommend next steps for firefly conservation.

Applied Research

- » Determine population sizes of firefly species, particularly threatened and DD species, to form a baseline and begin assessing trends over time.
- » Conduct research on the impacts of pesticides on fireflies and their prey; very little research to date has looked specifically at the effects on fireflies.
- » Grow collaborative research initiatives that work to fill in data gaps and protect highly at-risk species.
- » Conduct research that will inform the management and conservation of fireflies and their habitats, including studies of their ecology and natural history and the effects of various human activities (including mowing, timber management, grazing, insecticide use, and water modifications) on firefly population health.
- » Taxonomic research to complete new species descriptions, untangle lingering taxonomic uncertainties, and update species identification keys.

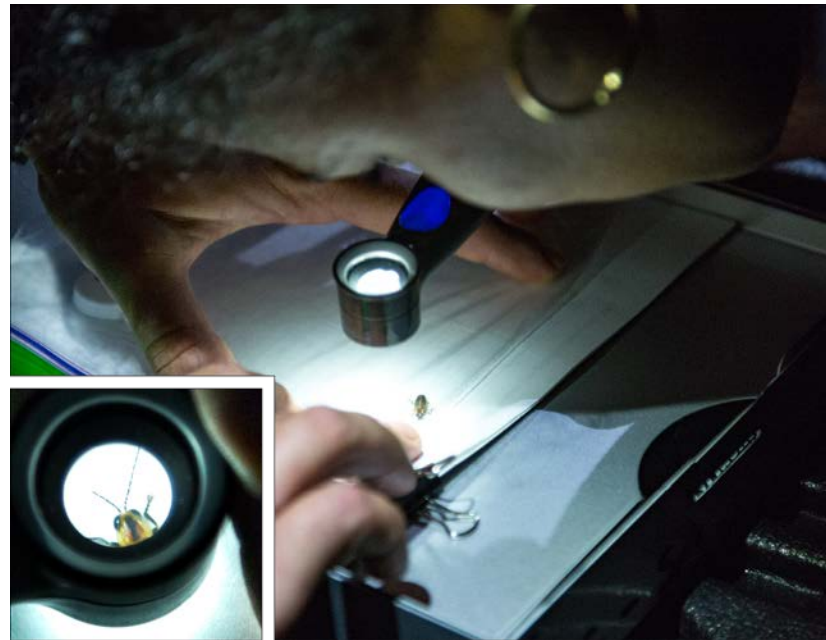


Figure 12—U.S. Fish and Wildlife Service at-risk conservation fellows & Delaware Division of Fish and Wildlife staff identify fireflies during a population survey for the Bethany Beach firefly. (Photos: Kayt Jonsson, USFWS / flickr.)

Figure 13—Research into firefly ecology and species' natural histories will be necessary to identify species that overlap, like these clearly different species signaling in the same meadow. (Photo: Brandom Keim / flickr.)





Figure 14—U.S. Fish and Wildlife Service at-risk conservation fellows & Delaware Division of Fish and Wildlife staff survey Bethany Beach for the endangered Bethany Beach firefly (Photo: Kayt Jonsson, USFWS / flickr.)

The term 'at-risk' is used here to include Near Threatened species as well as DD species we suspect are **threatened**.



Figure 15—Boardwalks like this one in Congaree National Park, South Carolina, help ensure visitor safety while protecting fireflies and their fragile wetland habitats. (Photo: Congaree National Park).

Surveys and Monitoring

- » Expand inventory and monitoring initiatives for fireflies. Participate in programs such as the Firefly Atlas (www.fireflyatlas.org), which is working to fill data gaps for **threatened** and DD species.
- » Monitor populations of **threatened** fireflies and follow adaptive management practices to ensure populations remain stable.
- » Fund and expand community science efforts like [Firefly Watch](#) and [Western Firefly Project](#) to include larger geographic areas, provide training opportunities, and develop tools to enable species-level identifications within these programs.
- » Develop a community science program for non-flashing species (i.e., daytime dark fireflies and glow-worms) or encourage reporting of such species through established programs like [iNaturalist](#).
- » Prioritize surveys for potentially at-risk DD species (see [Appendix C](#)) to determine whether they need conservation attention.
- » Digitize and ensure that collection data are shared with larger repositories such as the Global Biodiversity Information Facility (GBIF) and Symbiota Collections of Arthropods Network (SCAN) so that researchers, conservationists, and land managers have access to this information.

Habitat Protection and Enhancement

- » Work with major landowners and managers to restore and protect firefly habitat.
 - Prioritize protecting existing firefly habitat.
 - Protect both adult and larval habitat; keep in mind that fireflies spend the majority of their lives (up to two years or more) in the larval stage.
 - Restore degraded habitats, such as wetlands, where fireflies occur.
- » Determine the land ownership that underlies threatened species occurrences. How many occur in protected places like parks and reserves? How many are on private lands? Federal or state public

lands? Use this information to identify major landowners and managers who could play a role in firefly conservation, and work with them to develop species or habitat management plans.

- » Consider fireflies when developing agricultural conservation efforts; they are an important component of healthy soil ecosystems and spend the vast majority of their lives at or under the soil surface.
- » Create Firefly Sanctuaries that protect fireflies and their habitats, provide spaces for firefly research, and educate and engage the public in firefly conservation.
- » Follow and promote sustainable tourism guidelines at firefly tourist sites (see [US Firefly Tourism Resources on page 16](#) for details).

Species Protections

- » Include threatened and at-risk species as Species of Greatest Conservation Need (SGCN) in State and Regional Wildlife Action Plans (SWAPs); see [Appendix C](#) for a list of species by state and province.
- » Add imperiled species to relevant U.S. Forest Service (USFS) and Bureau of Land Management (BLM) sensitive species lists.
- » Protect highly imperiled species under the US Endangered Species Act (US ESA).

Education and Outreach

- » Expand education and outreach efforts to ensure that the best available science is accessible to practitioners, policymakers, land managers, and the public.
- » Educate the public on threats to fireflies and steps they can take to protect fireflies and their habitats.
- » Promote [Dark Sky Initiatives](#) to curtail light pollution, which is a major threat to 75% of firefly species in the US and Canada.
- » Include fireflies in lesson plans; talk about their biology and conservation needs; go on field trips to local natural areas to expose more people of all ages to the magic of fireflies.



Figure 16—Lottery winners of tickets to the Great Smoky Mountains National Park synchronous firefly event are brought to the site by trolley to limit the visitors' impact on the fireflies. (Photo: Warren Bielenberg, Great Smoky Mountains National Park / flickr.)



Figure 17—Well-designed exhibits like this one at the Utah Natural History Museum in Salt Lake City engage visitors while educating them about local species. The one-of-a-kind firefly model, named Franklin, [was sculpted by museum artist Emily Szalay](#). The habitat display has been converted into a traveling mini-diorama. (Photos: Utah Museum of Natural History.)

6

Further Reading

Conserving the Jewels of the Night: Guidelines for Protecting Fireflies in the United States and Canada <https://xerces.org/publications/guidelines/conserving-jewels-of-night>

Conserving the Jewels of the Night: Firefly-Friendly Lighting Practices <https://xerces.org/publications/fact-sheets/firefly-friendly-lighting> (available in English and Spanish)

Firefly Conservation: A Guide to Protecting the Jewels of the Night <https://xerces.org/publications/brochures/firefly-conservation>

The Xerces Society's Firefly Conservation Campaign <https://xerces.org/fireflies>

Silent Sparks: The Wondrous World of Fireflies by Sara Lewis <https://silentsparks.com/>

Fireflies, Glow-worms, and Lightning bugs: Identification and Natural History of the Fireflies of the Eastern and Central United States and Canada by Lynn Faust <https://ugapress.org/book/9780820348728/fireflies-glow-worms-and-lightning-bugs/>

Field Guide to Western North American Fireflies by Larry Buschman <https://entomology.k-state.edu/doc/Kansas%20Fireflies%20May%202015.pdf>

Evaluating firefly extinction risk: Initial Red List assessments for North America by Fallon et al. (2021). PLoS One. <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0259379>

US Firefly Tourism Resources

Visit xerces.org/fireflies to download additional resources for sustainable firefly tourism, including an easy-print Visitor's Etiquette Guide that can be displayed or distributed before events and a Site Manager's Guide with more information on conserving fireflies, recommendations for future action, and additional resources.

Figure 18—Three copies of the Visitor's Etiquette Guide can be printed on on letter paper using a small office printer, making it easy to share with participants before and during events.



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Appendix A

Checklist of Firefly Species in the US and Canada with Corresponding Red List Categories

SPECIES	TAXONOMIC AUTHORITY	COMMON NAME(S) ¹	RED LIST*	GROUP
<i>Aspisma ignitum</i>	Linnaeus, 1767	Dixon's striped firefly	LC	Flash
<i>Bicellonycha wickershamorum</i> !	Cicero, 1982	Southwest spring firefly	VU	Flash
<i>B. w. ssp. piceum</i> !	Cicero, 1982	Gila southwest spring firefly	EN	Flash
<i>B. w. ssp. wickershamorum</i> !	Cicero, 1982	Southwest spring firefly	VU	Flash
<i>Brachylampis blaisdelli</i>	VanDyke, 1939	Blaisdell's firefly	DD	Day
<i>Brachylampis sanguinicollis</i>	VanDyke, 1939	Blood-necked / red-collared firefly	DD	Day
<i>Ellychnia alexanderi</i>	Fender, 1969	Alexander's firefly	DD	Day
<i>Ellychnia autumnalis</i>	Melsheimer, 1852	Autumnal firefly	DD	Day
<i>Ellychnia bivulnerus</i> !	Green, 1949	Twice-wounded firefly	DD*	Day
<i>Ellychnia californica</i>	Motschulsky, 1854	California glow-worm; western firefly	DD	Day
<i>Ellychnia captiosa</i>	Fender, 1969	Tricky firefly	DD	Day
<i>Ellychnia corrusca</i>	Linnaeus, 1767	Winter firefly	LC	Day
<i>Ellychnia facula</i>	LeConte, 1857	Little torch firefly	DD	Day
<i>Ellychnia flavicollis</i>	LeConte, 1868	Yellow-necked / -collared firefly	DD	Day
<i>Ellychnia granulicollis</i>	Fender in Hatch, 1962	Granular-necked firefly	DD	Day
<i>Ellychnia greeni</i>	Fender in Hatch, 1962	Green's firefly	LC	Day
<i>Ellychnia hatchi</i>	Fender in Hatch, 1962	Pacific Northwest firefly	LC	Day
<i>Ellychnia irrorata</i>	Fender, 1969	Sprinkled firefly	DD	Day
<i>Ellychnia lacustris</i>	LeConte, 1852	Lake firefly	DD	Day
<i>Ellychnia megista</i>	Fender, 1970	Greater firefly	DD	Day
<i>Ellychnia obscurevittata</i>	Fender in Hatch, 1962	Obscured- / hidden- fillet firefly	DD	Day
<i>Ellychnia simplex</i>	LeConte, 1885	Simple firefly	DD	Day
<i>Lucidota atra</i>	G.A. Olivier, 1790	Black firefly; woodland Lucy	LC	Day
<i>Lucidota luteicollis</i> !	LeConte, 1878	Florida scrub dark firefly	VU	Day
<i>Lucidota punctata</i>	LeConte, 1852	Dotted firefly; tiny Lucy	LC	Day
<i>Micronaspis floridana</i> !	Green, 1948	Florida intertidal / mangrove / fiddler crab firefly	EN	Flash
<i>Microphotus angustus</i>	LeConte, 1874	California pink glow-worm	LC	Glow

KEY (SEE NOTES) *RED LIST Ranking² ! Species of Conservation Concern³ GROUP—Daytime dark, Flashing, Glow-worm








A Note About Flightless Females (♀)


As the adult females of many firefly species are flightless, this limits their ability to disperse, leaving them more vulnerable to habitat disturbance, destruction, or trampling, than their winged relatives. As this limited mobility increases a species' risk of extinction, whether or not a species is known to have flightless females has been included in the table below. Please note that in some of the DD species, the female form is unknown.

FLIGHTLESS ♀ ENDEMIISM		DOCUMENTED RANGE & STATUS BY US STATE & CAN PROVINCE [†]
No	—	US—FL?, TX?
No	AZ	US— <u>AZ</u>
No	AZ	US— <u>AZ?</u>
No	AZ	US— <u>AZ</u>
No	CA	US—CA?
No	CA	US—CA?
No	—	US—AZ?, CO?, UT?
No	—	US—AK?, ID?, IN?, MN?, MT?, NC?, NJ?, NY?, OH?, PA?, RI?, WA?, WI? CAN?—AB?, BC?, NT?, ON?, QC?
No	AZ	US— <u>AZ?</u>
No	—	US—CA, OR, WA CAN—BC
No	CA	US—CA?
No	—	US—AL, CO, CT, FL, GA, IA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MT, NC, ND, NH, NJ, NM, NY, OH, PA, RI, TN, VA, VT, WI, WV CAN—AB, BC, MB, NB, NL, NS, NT, ON, QC, PE, YT, SK
No	—	US—ID?, MT, OR?, WA? CAN—BC
No	—	US—CA?, CO, NM, NV?, TX
No	—	US—MT?, OR
No	—	US—CA?, OR?, WA CAN—BC
No	—	US—CA, MT, OR, WA CAN—BC
No	—	US—AZ?
No	—	US—MA?, MD?, ME?, MI?, MN?, NH?, NY?, TN?, VT?, WI?
No	CA	US—CA
No	OR	US—OR?
No	AZ	US—AZ
No	—	US—AL, AR, CT, DE, FL, GA, IA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, NC, NE, NH, NY, OH, OK, PA, RI, SC, TN, TX, VA, VT, WI, WV CAN—MB, NB, NS, ON, QC, PE
YES	FL	US— <u>FL</u>
No	—	US—AL, CT, GA, IN, KY, MA, MD, MI, MS, NC, NY, OH, PA, TN, VA, WI CAN—ON
No	—	US— <u>FL</u>
YES	—	US—AZ, CA, NM?

[†]**RANGE & STATUS**⁴—Extant, Presence uncertain?, (Possibly extant?), (Possibly extinct), [Not assessed], Species of Conservation Concern

Checklist of Firefly Species in the US and Canada... (CONTINUED)

SPECIES	TAXONOMIC AUTHORITY	COMMON NAME(S) ¹	RED LIST*	
<i>Microphotus chiricahuae</i>	Green, 1959	Chiricahua glow-worm	DD	Glow
<i>Microphotus dilatatus</i>	LeConte, 1866	Dilated glow-worm	DD	Glow
<i>Microphotus fragilis</i> 	E. Olivier, 1912	Fragile glow-worm	DD*	Glow
<i>Microphotus octarthrus</i>	Fall, 1912	Desert firefly	DD	Glow
<i>Microphotus pecosensis</i>	Fall, 1912	Pecos desert firefly; mountain glow-worm	DD	Glow
<i>Nelsonphotus aridus</i>	Cicero, 2006	Nelson's desert firefly	DD	Glow
<i>Paraphausis eximius</i> 	Green, 1949	Superb ghost	DD*	Day
<i>Phausis californica</i>	Fender, 1966	California / western ghost	DD	Glow
<i>Phausis dorotheae</i>	Fender in Hatch, 1962	Dorothy's ghost	DD	Glow
<i>Phausis inaccensa</i>	LeConte, 1878	Shadow ghost	LC	Glow
<i>Phausis luminosa</i>	Fender, 1966	Luminous ghost	DD	Glow
<i>Phausis marina</i>	Fender, 1966	Seaside / coastal ghost	DD	Glow
<i>Phausis nigra</i>	Hopping, 1937	Black ghost	DD	Glow
<i>Phausis reticulata</i>	Say, 1825	Blue ghost; Appalachian glow-worm firefly	LC	Glow
<i>Phausis rhombica</i>	Fender in Hatch, 1962	Rhombic ghost	DD	Glow
<i>Phausis riversi</i>	LeConte, 1884	River's ghost	DD	Glow
<i>Phausis skelleyi</i>	Fender in Hatch, 1962	Skelley's ghost	DD	Glow
<i>Photinus acuminatus</i> 	Green, 1956	Pointy-lobed firefly	EN	Flash
<i>Photinus aquilonius</i>	Lloyd, 1969	Northern firefly	DD	Flash
<i>Photinus ardens</i>	LeConte, 1852	Northern ablaze flash-train	DD	Flash
<i>Photinus australis</i>	Green, 1956	Twilight bush baby	LC	Flash
<i>Photinus brimleyi</i>	Green, 1956	Sidewinder; Brimley's photinus firefly	LC	Flash
<i>Photinus carolinus</i>	Green, 1956	Synchronous / Smokies synchronous firefly; light show	LC	Flash
<i>Photinus collustrans</i> 	LeConte, 1878	Florida fishhook; early field firefly	DD*	Flash
<i>Photinus concisus</i>	Lloyd, 1968	Concise / short firefly	LC	Flash
<i>Photinus consanguineus</i>	LeConte, 1852	Double cousin	LC	Flash
<i>Photinus consimilis</i>	Green, 1956	Cattail flash-train firefly	DD	Flash
<i>Photinus cookii</i>	Green, 1956	Cook's / fairy ring firefly	DD	Day
<i>Photinus curtatus</i>	Green, 1956	Clipped / brush single-flash firefly	LC	Flash
<i>Photinus dimissus</i> 	LeConte, 1881	Two-step flasher firefly	NT	Flash
<i>Photinus floridanus</i>	Fall, 1927	Florida sprite	DD	Flash
<i>Photinus frosti</i>	Green, 1956	Frost's firefly	DD	Flash
<i>Photinus granulatus</i> 	Fall, 1927	Lawn single-flash firefly	DD*	Flash

KEY (SEE NOTES) *RED LIST Ranking²  Species of Conservation Concern³  Group—Daytime dark, Flashing, Glow-worm








FLIGHTLESS ♀
 ENDEMICISM

DOCUMENTED RANGE & STATUS BY US STATE & CAN PROVINCE[†]

YES	AZ	US—AZ?
YES	—	US—AZ
YES	AZ	US—AZ
YES	—	US—AZ, NM, TX, UT?
YES	—	US—AZ, CO?, NM, TX, UT?
YES	—	US—CA?
PRESUMED YES	AZ	US—AZ
YES	—	US—CA?
YES	—	US—CA, OR?
YES	—	US—AL, AR, GA, IN, MI, MN, MS, NC, OK, PA, TN, TX
YES	—	US—AR?, OK?
YES	CA	US—CA?
YES	BC	CAN—BC
YES	—	US—AL, FL, GA, IL, IN, KY, NC, SC, TN, VA
YES	—	US—OR?, WA CAN—AB, BC
YES	—	US—CA, OR?
YES	—	US—OR?, WA?
No	—	US—(AL?), (FL), (GA?), (MS?), (NC), (OH), (SC?)
No	—	US—MA?, ME, MI?, MN?, SD?, WI? CAN?—MB?, NS?, ON?, QC?
No	—	US—IL?, MA?, ME, MI?, MN?, NY?, PA?, WI?, WV? CAN?—MB?, ON?, QC?
No	—	US—AL, AR, FL, GA, IL, IN, MO, MS, NC, TN
YES	—	US—AL, AR?, GA, KY, NC, OK?, TN
No	—	US—GA, KY, NC, NY, OH, PA, TN, VA, WV
YES	—	US—FL?, GA?
No	TX	US—TX
No	—	US—AL, AR, CT, DC, DE, FL, GA, IL, IN, KY, LA, MA, MD, ME, MI, MO, MS, NC, NH, NJ, NY, OH, OK, PA, RI, SC, TN, TX, VA, VT, WV CAN—MB, NS, ON
No	—	US—AL, AR, DC, DE, FL, GA, IL, IN, KY, LA, MD, MI, MO, MS, NC, NJ, NY, OH, OK, PA, SC, TN, VA, WV
No	—	US—AL?, FL?, IL?, KY?, MO, NC?, TN?, TX
No	—	US—IA, IL, IN, KS, MI, MO, NE, NY, OH, OK, PA, SD CAN—ON
YES	—	US—OK?, TX
No	—	US—(AL?), DE, FL?, (GA?), (MD?), (NC?), (SC?), (VA?)
No	—	US—FL?, LA?
YES	—	US—AR?, KS, OK?, TX

[†]RANGE & STATUS⁴—Extant, Presence uncertain?, (Possibly extant?), (Possibly extinct), [Not assessed], Species of Conservation Concern

Checklist of Firefly Species in the US and Canada... (CONTINUED)

SPECIES	TAXONOMIC AUTHORITY	COMMON NAME(S) ¹	RED LIST*	 GROUP
<i>Photinus greeni</i>	Lloyd, 1969	Green's firefly	LC	Flash
<i>Photinus ignitus</i>	Fall, 1927	Ignited / delayed photinus firefly	LC	Flash
<i>Photinus immaculatus</i> 	Green, 1956	Unblemished firefly	DD*	Flash
<i>Photinus indictus</i>	LeConte, 1881	Silent firefly	LC	Day
<i>Photinus knulli</i> 	Green, 1956	Southwest synchronous firefly	VU	Flash
<i>Photinus lineellus</i>	LeConte, 1852	Small-lined firefly	DD	Flash
<i>Photinus macdermotti</i>	Lloyd, 1966	Mr. Mac	LC	Flash
<i>Photinus marginellus</i>	LeConte, 1852	Little gray firefly	LC	Flash
<i>Photinus obscurellus</i>	LeConte, 1851	Murky flash-train	LC	Flash
<i>Photinus punctulatus</i> 	LeConte, 1852	Punctate firefly	DD*	Flash
<i>Photinus pyralis</i>	Linnaeus, 1767	Big dipper / common eastern / J-stroke firefly	LC	Flash
<i>Photinus sabulosus</i>	Green, 1956	Creekside tree blinkers	LC	Flash
<i>Photinus scintillans</i>	Say, 1825	Pale / yellow-bellied / pine barrens firefly	LC	Flash
<i>Photinus stellaris</i>	Fall, 1927	Starry firefly	LC	Flash
<i>Photinus tanytoxus</i>	Lloyd, 1966	Long arc firefly	DD	Flash
<i>Photinus tenuicinctus</i>	Green, 1956	Thinly girdled firefly	DD	Flash
<i>Photinus texanus</i>	Green, 1956	Texas tinie firefly; Texas tinies	LC	Flash
<i>Photinus umbratus</i>	LeConte, 1878	Shaded firefly	DD	Flash
<i>Photuris alexanderi</i>	Lloyd, 2018	UMBS firefly	NE	Flash
<i>Photuris alleganiensis</i>	Lloyd, 2018	Alleghany firefly	NE	Flash
<i>Photuris anna</i>	Heckscher, 2021	Anna's firefly	NE	Flash
<i>Photuris appalachianensis</i>	Lloyd, 2018	Appalachian dot-dash firefly	NE	Flash
<i>Photuris asacoa</i>	Lloyd, 2018	Leopold's firefly	NE	Flash
<i>Photuris aureolucens</i> 	Barber, 1951	Golden light / glow firefly	DD*	Flash
<i>Photuris barberi</i>	Lloyd, 2018	Barber's firefly	NE	Flash
<i>Photuris beanii</i>	Lloyd, 2018	Bean's firefly	NE	Flash
<i>Photuris bethaniensis</i> 	McDermott, 1953	Bethany Beach firefly	CR	Flash
<i>Photuris billbrowni</i>	Lloyd, 2018	Bill's hitch	NE	Flash
<i>Photuris branhami</i>	Lloyd, 2018	Double mother	NE	Flash
<i>Photuris bridgeniensis</i>	Lloyd, 2018	Hitched-single; Bridgen homestead firefly	NE	Flash
<i>Photuris caerulucens</i> 	Barber, 1951	Slow blue firefly; slow blues	DD*	Flash
<i>Photuris campestra</i>	Lloyd, 2018	Notch-dash flasher	NE	Flash








KEY (SEE NOTES) *RED LIST Ranking^{†2}  Species of Conservation Concern³  Group—Daytime dark, Flashing, Glow-worm

DOCUMENTED RANGE & STATUS BY US STATE & CAN PROVINCE[†]

No	—	US—(CT?), FL, (GA?), MA, MD, (NC?), NH, (NJ?), (NY?), (PA?), (RI?), (SC?), (VA?)
No	—	US—AL, CT, DE, MA, MD, ME, MN, NC, NH, NJ, NY, PA, RI, VA, VT CAN—NB, ON, QC
No	TX	US— <u>TX?</u>
No	—	US—AL, AR, GA, IL, IN, KS, LA, MI, MN, MO, NE, NY, OH, PA, SD, TN, TX, VT, WI CAN—ON, QC
No	—	US— <u>AZ</u>
No	—	US—AL?, FL, MS?, AR, TX, NE
No	—	US—(AL?), (AR?), (CT?), (DC?), DE, FL, (GA?), (IL?), (IN?), (KS?), KY, (LA?), MA, (MD?), MI, (MO?), (MS?), NC, (NH?), (NJ?), NY, (OH?), OK, PA, SC, TN, (VA?), (VT?), (WV?) (CAN?—ON?)
No	—	US—AL, (AR?), CT, (DC?), DE, IA, IL, IN, KY, LA, MA, MD, MI, MN, MO, MS, NC, NH, NJ, NY, OH, PA, (RI?), (SC?), TN, (VT?), WI, WV CAN—ON, QC
No	—	US—CT, (DC?), (DE?), IL, IN, MA, MD, ME, MI, MN, ND, NH, NJ, NY, OH, PA, (RI?), SD, (VT?), WI, WV CAN—MB, NB, NL, NS, ON, QC, PE
YES	—	US— <u>AR, IA?, IL?, KS?, MO?, OK?, TX?</u>
No	—	US—AL, AR, (AZ?), (CO), CT, DC, DE, FL, GA, IA, IL, IN, KS, KY, LA, MD, MI, MN, MO, MS, NC, NE, NJ, NY, OH, OK, PA, RI, SC, SD, TN, TX, VA, WI, WV CAN—ON
No	—	US—AL, DE, IL, KY, MD, MS, NC, NJ, NY, OH, PA, TN, VA CAN—ON
YES	—	US—DC, DE, IN, MD, MO, NJ, NY, OH, PA, VA, WV
YES	TX	US—TX
YES	—	US—FL?, GA?
No	—	US—AR?, OK?
No	—	US—TX
No	—	US—AL?, FL?, GA?, LA?, MS?, NC?, SC?
No	n/a	[US—MI]
No	n/a	[US—NY]
No	n/a	[US—NJ]
No	n/a	[US—MD]
No	n/a	[US—IA]
No	WI	US— <u>WI?</u>
No	n/a	[US—TX]
No	n/a	[US—FL]
No	—	US— <u>DE, MD</u>
No	n/a	[US—TX]
No	n/a	[US—FL]
No	n/a	[US—NY]
No	—	US— <u>MN?, WI</u>
No	n/a	[US—TX]

[†]RANGE & STATUS⁴—Extant, Presence uncertain?, (Possibly extant?), (Possibly extinct), [Not assessed], Species of Conservation Concern

Checklist of Firefly Species in the US and Canada... (CONTINUED)

SPECIES	TAXONOMIC AUTHORITY	COMMON NAME(S) ¹	RED LIST*	
<i>Photuris carrorum</i>	Lloyd, 2018	Carrs' crescendo	NE	Flash
<i>Photuris chenangoa</i>	Lloyd, 2018	Chenango firefly	NE	Flash
<i>Photuris cinctipennis</i> 	Barber, 1951	Belted firefly; flicker mother	EN	Flash
<i>Photuris congener</i> 	LeConte, 1852	Florida single snappy	DD*	Flash
<i>Photuris cowaselonensis</i>	Lloyd, 2018	Creek-Penn / Cowesalon Creek firefly	NE	Flash
<i>Photuris darwini</i>	Lloyd, 2018	Darwin's firefly	NE	Flash
<i>Photuris divisa</i>	LeConte, 1852	Flint Hills firefly; double flash	LC	Flash
<i>Photuris dorotheae</i>	Lloyd, 2018	Little red	NE	Flash
<i>Photuris douglasae</i>	Lloyd, 2018	Douglas' firefly	NE	Flash
<i>Photuris eliza</i>	Heckscher, 2021	Eliza's firefly	NE	Flash
<i>Photuris eureka</i>	Lloyd, 2018	Mallory Swamp firefly	NE	Flash
<i>Photuris fairchildi</i>	Barber, 1951	Cape Breton firefly; Fairchild's predator	LC	Flash
<i>Photuris flavicollis</i> 	Fall, 1927	Sky Island firefly	VU	Flash
<i>Photuris floridana</i>	Fall, 1927	Florida firefly	DD	Flash
<i>Photuris forresti</i> 	Lloyd, 2018	Loopy five / Forrest's firefly	EN	Flash
<i>Photuris frontalis</i>	LeConte, 1852	Snappy single sync firefly	LC	Flash
<i>Photuris gentrae</i>	Lloyd, 2018	Lesser Texas-red firefly	NE	Flash
<i>Photuris harrannorum</i>	Lloyd, 2018	Florida Versi (triple-flash)	NE	Flash
<i>Photuris hebes</i>	Barber, 1951	Heebie-jeebies; slow-hitch firefly	LC	Flash
<i>Photuris hiawasseensis</i>	Lloyd, 2018	Hiawasse River firefly	NE	Flash
<i>Photuris katrinae</i>	Lloyd, 2018	Texas red	NE	Flash
<i>Photuris lamarcki</i>	Lloyd, 2018	Sidewinder firefly	NE	Flash
<i>Photuris lineaticollis</i>	Motschulsky, 1854	Giant red	DD	Flash
<i>Photuris lloydi</i>	McDermott, 1966	Lloyd's predator; Highlands Hammock crescendo	LC	Flash
<i>Photuris lucicrescens</i>	Barber, 1951	July comets; big scaries; big-Lucy; great crescendo	LC	Flash
<i>Photuris lynfaustae</i>	Lloyd, 2018	Hitched red	NE	Flash
<i>Photuris maicoi</i>	Lloyd, 2018	Big red	NE	Flash
<i>Photuris margotooleae</i>	Lloyd, 2018	Integrity firefly	NE	Flash
<i>Photuris missouriensis</i>	McDermott, 1962	Prairie train firefly	DD	Flash
<i>Photuris moorei</i>	Lloyd, 2018	Fast crescendo	NE	Flash
<i>Photuris mysticalampas</i> 	Heckscher, 2013	Mysterious lantern / mystic lantern firefly	EN	Flash
<i>Photuris paludivulpes</i>	Lloyd, 2018	Swamp-fox firefly	NE	Flash
<i>Photuris patriei</i>	Lloyd, 2018	Oklawaha	NE	Flash
<i>Photuris pensylvanica</i> 	DeGeer, 1774	Dot-dash / Pennsylvania firefly; Barber's Penn	VU	Flash

KEY (SEE NOTES) *RED LIST Ranking²  Species of Conservation Concern³  Group—Daytime dark, Flashing, Glow-worm













FLIGHTLESS ♀
ENDEMICISM

DOCUMENTED RANGE & STATUS BY US STATE & CAN PROVINCE†

No	n/a	[US—FL, SC]
No	n/a	[US—NJ, NY]
No	—	US— <u>DE</u> , <u>MD</u>
No	—	US— <u>FL</u> , (GA?)
No	n/a	[US—NY]
No	n/a	[US—AL, GA, KY, SC, TN, VA]
No	—	US—IL, KS, MO, OK
No	n/a	[US—FL, GA, NC]
No	n/a	[US—FL, GA]
No	n/a	[US—DE]
No	n/a	[US—FL]
No	—	US—CT, (DC?), (DE?), GA, IA, (IL?), (IN?), KY, MA, MD, ME, MI, MN, MO, NC, NE, NH, NJ, NY, OH, (PA?), SC, SD, TN, VA, VT, WI, WV CAN—NS, ON
PRESUMED No	TX	US— <u>NM?</u> , <u>TX</u>
No	FL	US—FL?
No	—	US— <u>GA</u> , <u>SC</u> , <u>TN</u>
No	—	US—AL, DC, DE, FL, GA, MD, MS, NC, SC, TN, TX
No	n/a	[US—TX]
No	n/a	[US—FL]
No	—	US—AR, DC, DE, GA, IN, MD, NC, NY, OH, OK, PA, SC, TN, TX, WV
No	n/a	[US—SC, TN, WV]
No	n/a	[US—TX]
No	n/a	[US—FL, GA, SC]
No	FL	US—FL?
No	FL	US—FL
No	—	US—AL, AR, DC, DE, GA, IA, IL, IN, KS, KY, LA, MA, MD, MO, MS, NC, NE, NJ, NY, OH, PA, SC, TN, VA, WV
No	n/a	[US—GA]
No	n/a	[US—FL]
No	n/a	[US—CT, NY]
No	—	US—AR?, IA?, KS?, KY?, MO?, OH?
No	n/a	[US—GA, MO]
No	DE	US— <u>DE</u>
No	n/a	[US—SC]
No	n/a	[US—FL]
No	—	US—DC?, <u>DE</u> , <u>MD</u> , <u>NJ?</u> , <u>NY?</u> , <u>PA?</u>

†RANGE & STATUS⁴—Extant, Presence uncertain?, (Possibly extant?), (Possibly extinct), [Not assessed], Species of Conservation Concern

Checklist of Firefly Species in the US and Canada... (CONTINUED)

SPECIES	TAXONOMIC AUTHORITY	COMMON NAME(S) ¹	RED LIST*	
<i>Photuris polacekiae</i>	Lloyd, 2018	Polacek's firefly	NE	Flash
<i>Photuris potomaca</i> 	Barber, 1951	Potomac River firefly	DD*	Flash
<i>Photuris pyralomima</i> 	Barber, 1951	Common eastern mimic, <i>Pyralis</i> -mimicking firefly	EN	Flash
<i>Photuris quadrifulgens</i>	Barber, 1951	Spring 4-flasher	LC	Flash
<i>Photuris salina</i> 	Barber, 1951	Salt marsh firefly	NT	Flash
<i>Photuris sellicki</i>	Heckscher, 2021	Sellick's firefly	NE	Flash
<i>Photuris sheckscheri</i>	Heckscher, 2021	Schecksher's firefly	NE	Flash
<i>Photuris sivinskii</i>	Lloyd, 2018	Quick 1-2	NE	Flash
<i>Photuris stanleyi</i>	Lloyd, 2018	Florida tremulans; Stanley's firefly	NE	Flash
<i>Photuris stevensae</i>	Lloyd, 2018	Nettie's firefly	NE	Flash
<i>Photuris tasunkowitcoi</i>	Lloyd, 2018	Crazy Horse firefly	NE	Flash
<i>Photuris tremulans</i>	Barber, 1951	Christmas lights; confusing firefly	LC	Flash
<i>Photuris versicolor</i>	Fabricius, 1798	Variable triple-flash firefly; multi-flash predator	LC	Flash
<i>Photuris walkeri</i>	Lloyd, 2018	Long red	NE	Flash
<i>Photuris walldoxeyi</i> 	Faust, 2019	Cypress / Wall Doxey's firefly	VU	Flash
<i>Photuris whistlerae</i>	Lloyd, 2018	Whistler's mother	NE	Flash
<i>Pleotomodes knulli</i>	Green, 1949	Anthill firefly	DD	Glow
<i>Pleotomodes needhami</i> 	Green, 1948	Ant-loving scrub firefly	EN	Glow
<i>Pleotomus nigripennis</i>	LeConte, 1885	Black-winged firefly	DD	Glow
<i>Pleotomus pallens</i>	LeConte, 1866	Pale glow-worm	LC	Glow
<i>Pollaclasis bifaria</i>	Say, 1835	Branched Polly	DD	Day
<i>Prolutacea pulsator</i> 	Cicero, 1984	Pulsating firefly	DD*	Glow
<i>Pterotus curticornis</i>	Chemsak, 1978	Short-horned glow-worm	DD	Glow
<i>Pterotus obscuripennis</i>	LeConte, 1859	Douglas fir glow-worm	LC	Glow
<i>Pyractomena angulata</i>	Say, 1825	Say's / candle / angled firefly	LC	Flash
<i>Pyractomena angustata</i> 	LeConte, 1851	Glowing / narrow spring firefly	DD*	Flash
<i>Pyractomena barberi</i> 	Green, 1957	Barber's spring firefly	DD*	Flash
<i>Pyractomena borealis</i>	Randall, 1828	Spring treetop flasher; northern firefly	LC	Flash
<i>Pyractomena dispersa</i> 	Green, 1957	Marsh flicker; wiggle dancer (western states)	DD*	Flash
<i>Pyractomena ecostata</i> 	LeConte, 1878	Keel-necked / striped firefly	EN	Flash
<i>Pyractomena floridana</i> 	Green, 1957	Florida spring firefly	DD*	Flash
<i>Pyractomena limbicollis</i>	Green, 1957	Margin-necked firefly	DD	Flash






KEY (SEE NOTES) *RED LIST Ranking^{†2}  Species of Conservation Concern³  Group—Daytime dark, Flashing, Glow-worm



DOCUMENTED RANGE & STATUS BY US STATE & CAN PROVINCE[†]

No	n/a	[US—TX]
No	—	US— <u>CT?</u> , <u>DC?</u> , <u>KY?</u> , <u>MD?</u> , <u>OH?</u> , <u>VA?</u> , <u>WV?</u>
No	—	US— <u>DE</u> , <u>NY?</u>
No	—	US—AL, AR, CT, GA, (IA?), IL, IN, KY, MA, MD, MI, MO, MS, NC, NJ, NY, OH, OK, PA, SC, TN, VA
No	—	US— <u>DE</u> , <u>MD</u> , <u>NJ</u> , (VA?)
No	n/a	[US—NY]
No	n/a	[US—DE, NJ]
No	n/a	[US—FL, GA, MO]
No	n/a	[US—FL, GA]
No	n/a	[US—CT, MA, NY]
No	n/a	[US—ND]
No	—	US—AL, (AR?), (CT?), (DC?), (DE?), (GA?), (IL?), (IN?), (KY?), MA, (MD?), (MO?), (MS?), (NC?), (NJ?), (NY?), (OH?), (OK?), (PA?), (SC?), TN, VA, (WV?)
No	—	US—AL, DC, DE, FL, GA, IL, IN, (KS?), KY, MD, (MO?), MS, NC, NJ, NY, OH, PA, SC, TN, VA, WV
No	n/a	[US—FL]
No	—	US— <u>IL</u> , <u>IN</u> , (KY?), <u>MS</u> , <u>TN</u>
No	n/a	[US—FL]
YES	FL	US—FL?
YES	FL	US— <u>FL</u>
YES	—	US—AZ, (CA?), NM?, TX
YES	—	US—KS, OK, TX
No	—	US—(AL?), FL, (GA?), (IL?), IN, (KY?), LA, (MI?), MS, (NC?), (NY?), OH, (PA?), (SC?), TN, VA, WI, (WV?) CAN—ON, QC
YES	—	US— <u>AZ</u>
PRESUMED YES	—	US—(AZ?), CA?, (NM?), TX
YES	—	US—CA, OR, WA
No	—	US—AL, AR, CT, DC, DE, FL, GA, IA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, NC, ND, NE, NH, NJ, NY, OH, OK, PA, RI, SC, SD, TN, TX, VA, VT, WI, WV CAN—MB, NB, NS, ON, QC
No	—	US— <u>AL?</u> , <u>FL?</u> , <u>GA?</u> , <u>MS?</u>
No	FL	US— <u>FL?</u>
No	—	US—AL, AR, CT, DC, DE, FL, GA, IA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, NC, NH, NJ, NY, OH, OK, PA, RI, SC, TN, TX, VA, VT, WI, WV CAN—AB, MB, NS, ON, QC, SK
No	—	US— <u>AL</u> , <u>AR</u> , <u>AZ?</u> , <u>CO</u> , <u>CT</u> , <u>DC</u> , <u>DE?</u> , <u>GA</u> , (IA?), <u>ID</u> , (IL?), (KS?), <u>KY</u> , <u>MA</u> , <u>MD</u> , <u>ME</u> , <u>MI</u> , <u>MO</u> , <u>MS</u> , (MT?), <u>ND</u> , (NE?), <u>NH</u> , <u>NJ</u> , (NM?), <u>NY</u> , <u>OH</u> , <u>OK</u> , <u>PA</u> , (RI?), (SD?), <u>TN</u> , <u>UT</u> , <u>VA</u> , <u>VT</u> , <u>WA</u> , (WV?), (WY?) CAN— <u>AB</u> , <u>MB</u> , <u>SK</u>
No	—	US— <u>AL</u> , <u>DE</u> , <u>FL</u> , <u>NJ</u>
No	—	US— <u>AL?</u> , <u>FL?</u> , <u>MS?</u>
No	FL	US—FL?

[†]RANGE & STATUS⁴—Extant, Presence uncertain?, (Possibly extant?), (Possibly extinct), [Not assessed], Species of Conservation Concern

Checklist of Firefly Species in the US and Canada... (CONTINUED)

SPECIES	TAXONOMIC AUTHORITY	COMMON NAME(S) ¹	RED LIST*	
				
<i>Pyractomena linearis</i>	LeConte, 1852	Marsh gray	DD	Flash
<i>Pyractomena lucifera</i> 	Melsheimer, 1845	Marsh imp	DD*	Flash
<i>Pyractomena marginalis</i> 	Green, 1957	Marginal firefly	DD*	Flash
<i>Pyractomena palustris</i>	Green, 1957	Marsh diver	DD	Flash
<i>Pyractomena punctiventris</i>	LeConte, 1878	Texas hookers	LC	Flash
<i>Pyractomena similis</i>	Green, 1957	Similar firefly	DD	Flash
<i>Pyractomena sinuata</i> 	Green, 1957	Notched firefly	DD*	Flash
<i>Pyractomena vexillaria</i> 	Gorham, 1881	Amber comet firefly	EN	Flash
<i>Pyropyga decipiens</i>	Harris, 1836	Sneaky elf	LC	Day
<i>Pyropyga minuta</i>	LeConte, 1852	Flower elf	LC	Day
<i>Pyropyga modesta</i>	Green, 1961	Modest elf	DD	Day
<i>Pyropyga nigricans</i>	Say, 1823	Black-bordered elf	LC	Day
<i>Tenaspis angularis</i>	Gorham, 1880	Tropic traveler; angeled tenaspis firefly	DD	Day

KEY (SEE NOTES) *RED LIST Ranking²  Species of Conservation Concern³  Group—Daytime dark, Flashing, Glow-worm

NOTES:

- COMMON NAMES**—Wherever possible, the known common names for each species have been included in this list (e.g., those listed by Faust 2017, Lloyd 2018, IUCN 2021). When a species had no documented common name, the scientific name was translated.
- RED LIST Ranking**—Critically Endangered (**CR**), Endangered (**EN**), Vulnerable (**VU**), Near Threatened (**NT**), Least Concern (**LC**), Data Deficient (**DD**). Note: **DD*** species are species of conservation concern (see #3 below). See [Understanding IUCN Red List Rankings on page 7](#) for more information.
- Species of Conservation Concern**—CR, EN, VU, NT, and DD* species suspected to be of high conservation concern and thus recommended for state-level protection, such as inclusion on a state's Species of Greatest Conservation Need lists or targeted for specific conservation programs. See [Appendix C on page 53](#) for more information.
- RANGE & STATUS**—Extant

Extant	Species recorded since 2000
Presence uncertain?	Species recorded prior to 2000
(Possibly extant?)	No known records but habitat or locality is appropriate and species may occur here
(Possibly extinct)	Species has not been seen in many years despite comprehensive survey efforts
[Not assessed]	Species not yet assessed for the Red List so distribution is considered tentative
Species of Conservation Concern	Species suspected to be of high conservation concern. See #3.

FLIGHTLESS ♀
ENDEMISM

DOCUMENTED RANGE & STATUS BY US STATE & CAN PROVINCE[†]

No	—	US—MA, ME?, MI?, MN?, NH?, NY?, PA?, WI? CAN—AB?, MB, ON, QC?
No	—	US—AL, DC, DE, FL, GA, IL, IN, LA, MA, MD, MI, MN, MS, NC, ND, NY, OH, OK, PA, SC, SD, TX, VA, WI CAN—ON, QC
No	—	US—AL?, AR?, CT?, DC?, GA?, IL?, MA?, MD?, ME?, NC?, NH?, NJ?, NY?, OH, OK?, PA, SC?, TN, TX, VA?
No	—	US—(AL?), AR?, DC?, MD?, (MO?), MS?, TN?, VA?
No	—	US—TX
No	—	US—AL?, MD?, MS?, SC?, VA?
No	—	US—CT, (IL?), (KS?), (MN?), ND, NE, (NH?), (PA?), (SD?), VT, (WI?) (CAN?—MB?)
No	—	US—TX
No	—	US—CT, IA, IL, IN, KS, KY, MA, MD, MO, NE, NJ, NY, OH, PA, VT, WI CAN—NB, ON, QC, PE
No	—	US—CO, FL, GA, LA, NM, OK, TN, TX
No	—	US—AZ, MO, NM, OK, TX
SOMETIMES	—	US—AZ, CA, CO, ID, IN, KY, ME, MI, MT, NJ, NM, NV, NY, OK, TX, UT, VA, WA CAN—AB, BC, MB, ON, QC, (SK?)
No	—	US—FL, LA, MO, TX

[†]RANGE & STATUS⁴—Extant, Presence uncertain?, (Possibly extant?), (Possibly extinct), [Not assessed], Species of Conservation Concern



Microphotus angustus flightless female

—CA

Ken-ichi Ueda / flickr



Pyractomena sp. adults mating

—GA

Judy Gallagher / flickr

Appendix B

Threatened & Near Threatened Species Profiles

All of these species profiles were compiled based on information gathered from the IUCN Red List assessments (IUCN 2021) and augmented with new information that has become available since their publication. Full Red List assessments (including range maps) are available at www.iucnredlist.org/.

Conservation Status

IUCN—Red List ranking (see See [Understanding IUCN Red List Rankings on page 7](#) for more information).

NS—NatureServe Global (G), National (N), and Subnational (S) Conservation Status Rank:

GX NX SX	Not located despite intensive searches and virtually no likelihood of rediscovery
GH NH SH	Known from only historical occurrences but still some hope of rediscovery
G1 N1 S1	At very high risk of extinction or collapse
G2 N2 S2	At high risk of extinction or collapse
G3 N3 S3	At moderate risk of extinction or collapse
G4 N4 S4	At fairly low risk of extinction or collapse
G5 N5 S5	At very low risk or extinction or collapse
GNA NNA SNA	A conservation status rank is not applicable because the species or ecosystem is not a suitable target for conservation activities
GNR NNR SNR	Global rank not yet assessed
GU NU SU	Currently unrankable due to lack of information or due to substantially conflicting information about status or trends
G#G# N#N# S#S#	Numeric range rank (e.g., G2G3, G1G3) is used to indicate uncertainty about the exact status of a taxon or ecosystem type

SGCN—Species of Greatest Conservation Need, legal designation by state

US ESA—Species' legal status under the US Endangered Species Act

Male Size Ranges

The documented size range for males of each species has been provided in the profiles as follows:

9–10 mm



With the smallest size in grey () superimposed over the largest size in green (). When printed at 100% scale, the bars match the lengths provided.

Habitat Threats

Pollution	Agriculture	Habitat Loss, Degradation, Fragmentation	Climate & Severe Weather
Excess light	Crop systems	Habitat loss	Climate change
Energy & mining	Livestock & pasture	Trampling / crushing	Severe storms & flooding
Pesticides & run-off		Invasive species	Drought
		Water quality	Rising temperatures
			Sea level rise

Bicellonycha wickershamorum
Southwest Spring Firefly



< VULNERABLE >

VU



Figure 18—The species' habitat along the Cienegas Creek in the Las Cienegas National Conservation Area [above]; an adult southwest spring firefly [below]. (Photos: Patrick Alexander / flickr [above]; Doug Danforth / BugGuide [below].)

Conservation Status

- » IUCN: VU
- » NS: G2G3, SNR (AZ)
- » SGCN: None
- » US ESA: Not listed

Distribution

USA—Arizona

Description

The southwest spring firefly is found in montane desert habitats of Arizona, including wet and marshy areas in the Madrean Sky Islands and surrounding foothills and stream canyons. The main threats to this species are climate change and habitat loss and degradation due to cattle grazing and modification for agriculture and pasturing. However, light pollution is also of concern. Adults are active from early June to late July, before summer monsoons, and communicate using a green flash-answer routine. See subspecies below for more information.



9–10 mm



< EN > ***Bicellonycha wickershamorum ssp. piceum***
Gila Southwest Spring Firefly

Conservation Status

- » IUCN: EN
- » NS: G2G3T1T2, SNR (AZ)
- » SGCN: None
- » US ESA: Not listed

Distribution

USA—Arizona

Description

This subspecies has only been reported from its type locality near Morenci, AZ. Because of this, not much is known about its

habitat associations. However, like its parent species, *B. wickershamorum*, it is likely a riparian desert specialist. The type locality where this subspecies has been documented is a seepage area within a floodplain of a permanent river.

The Gila southwest spring firefly is threatened by habitat degradation and loss due to mining, trampling by cattle, and modification for pasturing and agriculture, in addition to flooding and light pollution. Surveys throughout the area from where it has been reported are needed to determine if the species remains extant, and to get a better understanding of this subspecies' distribution.



Figure 19—Seep habitat along Eagle Creek, close to the type locality. The actual type locality for this species is likely lost. (Photo: Anna Walker) No photos of this subspecies are available.

Flash Pattern & Activity Period

Adults are active from dusk to dark from June to July. The flash behavior of this subspecies is not known because too few individuals have been observed.



Bicellonycha wickershamorum* ssp. *wickershamorum **Southwest Spring Firefly**

9–10 mm



Conservation Status

- » IUCN: VU
- » SGCN: None
- » NS: G₂G₃T₂T₃, SNR (AZ)
- » US ESA: Not listed

Description

This subspecies is the more widespread of the two subspecies and therefore is also referred to as the southwest spring firefly. As suggested in the species level account, it can be found in montane desert habitats in Arizona at elevations ranging from 4,000–6,000 feet. This includes habitats in the Madrean Sky Islands and surrounding foothills and stream canyons, where it is associated with marsh areas and other ephemeral habitats along permanent streams, including seeps and areas with standing water.

The main threats to this species are climate change and habitat loss and degradation due to cattle grazing and modification for agriculture and pasturing. However, light pollution is also of concern.

Flash Pattern & Activity Period

Adult males pronounce one flash per interval, but the duration of the flash and the timing between intervals have not been recorded. A diagnostic feature of this subspecies is the way it flashes higher and higher above ground as the sun sets. In southern Arizona, this subspecies and *Photinus knulli* are the only known flashers.

Distribution

USA—Arizona



Figure 20—The southwest spring firefly [top] has a complicated flash pattern that has yet to be described [bottom]. (Photos: Scott Cylwik.)

Lucidota luteicollis
Florida Scrub Dark Firefly



< VULNERABLE >

VU



Figure 21—An example of the species' longleaf pine habitat [above]; adult male Florida scrub dark firefly [middle]; male and female aboveground [bottom]. (Photos: Leo Miranda, USFWS / Flickr [above]; Brandon Woo / BugGuide [middle]; James E. Lloyd / University of Florida [bottom].)

Conservation Status

- » IUCN: VU
- » NS: G1G2, SNR (FL)
- » SGCN: None
- » US ESA: Not listed

Distribution

USA—Florida

Description

The Florida scrub dark firefly is a habitat specialist associated with very dry habitats in Florida's scrub, sandhill, and longleaf pine savannah habitats. It appears to be confined to upland ridges. The activity period of this diurnal species is not well known. Flightless adult females, which are subterranean, likely attract males by releasing pheromones. Females may avoid coming aboveground even to mate; opting instead to mate with males through the sand.

Threats to this species include habitat loss and degradation, climate change and associated drought, and trampling of flightless females.

Flash Pattern & Activity Period

This is a daytime dark firefly species that uses pheromones to find mates. Adults are active in July and August. Adult males are technically luminescent, but do not seem to use their lights for mating.



Micronaspis floridana
Florida Intertidal Firefly



< **ENDANGERED** >

EN



Figure 22—One of the species' localities in Cedar Key, Florida [above]; *Micronaspis floridana* adult [below]. (Photos: Rain0975 / Flickr [above]; Drew Fulton [below].)

Conservation Status

- » **IUCN:** EN
- » **NS:** G1G2; S1S3 (FL)
- » **SGCN:** Florida
- » **US ESA:** Not listed

Distribution

USA—Florida; Bahamas

Description



8–12 mm

True to its name, the Florida intertidal firefly inhabits the intertidal zone of salt marshes, mudflats, and mangroves in coastal areas. It occurs along the Florida coast and on some northern islands of the Bahamas. Adults can be active year-round, but particularly from March through May.

This species is threatened by coastal development, light pollution, agricultural activities, and pesticides. Mangroves are among the most endangered coastal habitats in Florida, and many have already been decimated, potentially leading to the decline of this species. Sea-level rise and increasing frequency and severity of hurricanes and other storms may also pose a threat. Several populations in Florida now appear to be locally extinct.

Flash Pattern & Activity Period

Adults may be found year-round but peak activity is in March–May with displays starting 40–90 minutes after sunset. Males emit short single or bimodal yellowish-green flashes every couple of seconds; females respond with prolonged, modulated glow-flashes lasting up to a minute.

	0	1	2	3	4	5	6	Seconds
♂	[Flash]	[Flash]	[Flash]	[Flash]	[Flash]	[Flash]	[Flash]	→ Single flash over half a second, repeated every 1 or 2 seconds
♂	[Flash]	[Flash]	[Flash]	[Flash]	[Flash]	[Flash]	[Flash]	→ Double flash over half a second, repeated every 1 or 2 seconds
♀	[Glow]	[Glow]	[Glow]	[Glow]	[Glow]	[Glow]	[Glow]	→ Response glow for up to a minute

Photinus acuminatus
Pointy-Lobed Firefly



< **ENDANGERED** >

EN



Figure 23—Type locality habitat documented with the first observations of the species on Mount Pisgah in North Carolina [above]; adult male observed on a leaf. (Photos: Jim Liestman / Flickr [above]; James E. Lloyd / University of Florida [below].)

Conservation Status

- » **IUCN:** EN
- » **NS:** G1, SNA (AL), SNR (FL, GA, NC, OH, SC), SU (MS)
- » **SGCN:** South Carolina
- » **US ESA:** Not listed

Distribution

USA—Alabama, Florida, Georgia, Mississippi, North Carolina, Ohio, South Carolina



7–8 mm



Description

The pointy-lobed firefly is a habitat specialist found in bog and marsh habitats. This species has a wide range but appears to have been extirpated from some areas. It has been reported from Alabama, Florida, Georgia, Mississippi, North Carolina, Ohio, and South Carolina, although it may be more widespread but overlooked. Populations in Florida and South Carolina may be extinct.

Habitat loss and light pollution are the leading threats to this species.

Flash Pattern & Activity Period

Adults are active for a short period around dusk in June and July. This species has a generic flash pattern with males emitting bright yellow, fast flashes every two seconds. Females respond with their own flashes. Unlike most firefly species, displaying males do not congregate together but instead scatter out across a large area. Because they often co-occur with other firefly species, this can make it difficult to distinguish them.

	0	1	2	3	4	5	6	Seconds
♂	█		█		█			→ Short single flash repeated every 2 seconds
♀		█		█		█		→ Short response flash following each male flash

Photinus dimissus
Two-Step Flasher Firefly



NEAR THREATENED
NT



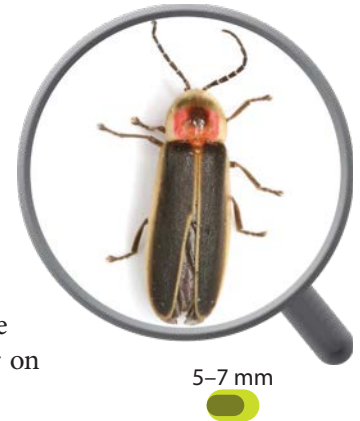
Figure 24—The two-step flasher firefly (*Photinus dimissus*) [below] is now known from only a few localities in Texas and Oklahoma, including Guadalupe River State Park in Texas [above]. (Photos: Mike Quinn / BugGuide [below]; Amber Lujan (amboo213) / Flickr [above].)

Conservation Status

- » IUCN: NT
- » NS: G3, SNA (OK), SNR (TX)
- » SGCN: None
- » US ESA: Not listed

Distribution

USA—Texas, Oklahoma



Description

The two-step flasher firefly (*Photinus dimissus*) was historically found in isolated patches along riparian corridors throughout southern Oklahoma and central Texas. Recent surveys for the species have identified only a few extant localities, primarily within protected natural areas or on private property. It is associated with undisturbed grasslands along waterways.

Threats to this species include habitat disturbance and loss, particularly due to growing residential development, trampling of flightless adult females, light pollution, and loss and degradation of critical water resources.

Flash Pattern & Activity Period

As its common name suggests, males of this species produce a twinkling yellow flash that appears bimodal about once a second; females respond at a quick fraction of a second delay.

	0	1	2	3	4	5	6	Seconds
♂	●		●		●		●	→ Single flash repeated once per second
♀		●		●		●		→ Response flash following each male flash

Photinus knulli
Southwest Synchronous Firefly



< **VULNERABLE** >

VU



Figure 25—Type habitat from the area species was first documented in Peña Blanca Canyon, Arizona [above]; live male specimen. (Photos: Alan Schmierer / Flickr [above]; Arthur V. Evans [below].)

Conservation Status

- » **IUCN:** VU (tentative, unpublished)
- » **NS:** G2G3; SNR (AZ)
- » **SGCN:** None
- » **US ESA:** Not listed

Distribution

USA—Arizona; **MEX**—Sonora



5–8 mm

Description

The Southwest synchronous firefly is found primarily in southeastern Arizona and northern Sonora, Mexico. Males of this species congregate to put on unusual synchronous flash displays from lek arenas. These leks, where larvae and adult females also tend to gather, are typically found near permanently wet areas of xeric habitats like desert streams.

Because of its congregating behavior, this synchronous firefly is especially vulnerable to extinction due to human-caused habitat modification and drought. It has already been extirpated from at least one locality.

Flash Pattern & Activity Period

Adults are active in July and August, 35–120 minutes after sunset. The flash displays are composed of triplet yellow flashes emitted about every six seconds.



	0	1	2	3	4	5	6	Seconds	
♂	●	●	●						→ Three (to rarely six) flashes over one second, repeated at six second intervals
♀	▨	▨	▨	▨	▨	▨	▨		→ Female response is extremely varied, ranging from short pulses to long, continuous glows

Photuris bethaniensis

Bethany Beach Firefly



CRITICALLY ENDANGERED
CR



Figure 26—Bethany Beach firefly freshwater interdunal swale habitat along the Atlantic coastline [above]; a pinned specimen [middle]; firefly collected during a survey. (Photos: Emily May [above]; Christopher M. Heckscher [middle]; Kayt Jonsson, USFWS / flickr [bottom].)

Conservation Status

- » IUCN: CR
- » NS: G1; S1 (DE), SNA (MD)
- » SGCN: Delaware (DE)
- » US ESA: Under review for listing (USFWS 2021)
- » DE ESA: Endangered

Distribution

USA—Delaware, Maryland

Description

The Bethany Beach firefly is a habitat specialist primarily associated with threatened freshwater interdunal wetlands that occur along a 20-mile stretch of Delaware’s Atlantic coast, although additional populations are now documented in Maryland. These wetland habitats form in barrier beach systems in the shallow depressions found between sand dunes. While brackish swales can be found all along the east coast, freshwater swales are less common. These swales are characterized by saturated soils that are seasonally inundated by freshwater from aquifers and recharged with rainfall. Organic matter that builds up in the swales provides habitat for Bethany Beach firefly larvae, which hunt along the soil surface and pupate in chambers just under the soil surface or under logs.

Currently, the most significant threat to this species is habitat loss and fragmentation due to coastal development. Other threats include decreased water quality, recreational activities and related infrastructure, habitat fragmentation, light pollution, pesticides, and climate change-induced sea-level rise, increased incidence of severe storms, and increased temperatures and phenological shifts (changes in the timing of a species’ life cycle events). Loss of larval prey species, invasive plants such as the common reed (*Phragmites australis*), and disease or predation may be impacting the Bethany Beach firefly as well.

(continued on next page)



9–10.75 mm



***Photuris bethaniensis* (CONTINUED)**
Bethany Beach Firefly



CRITICALLY ENDANGERED
CR

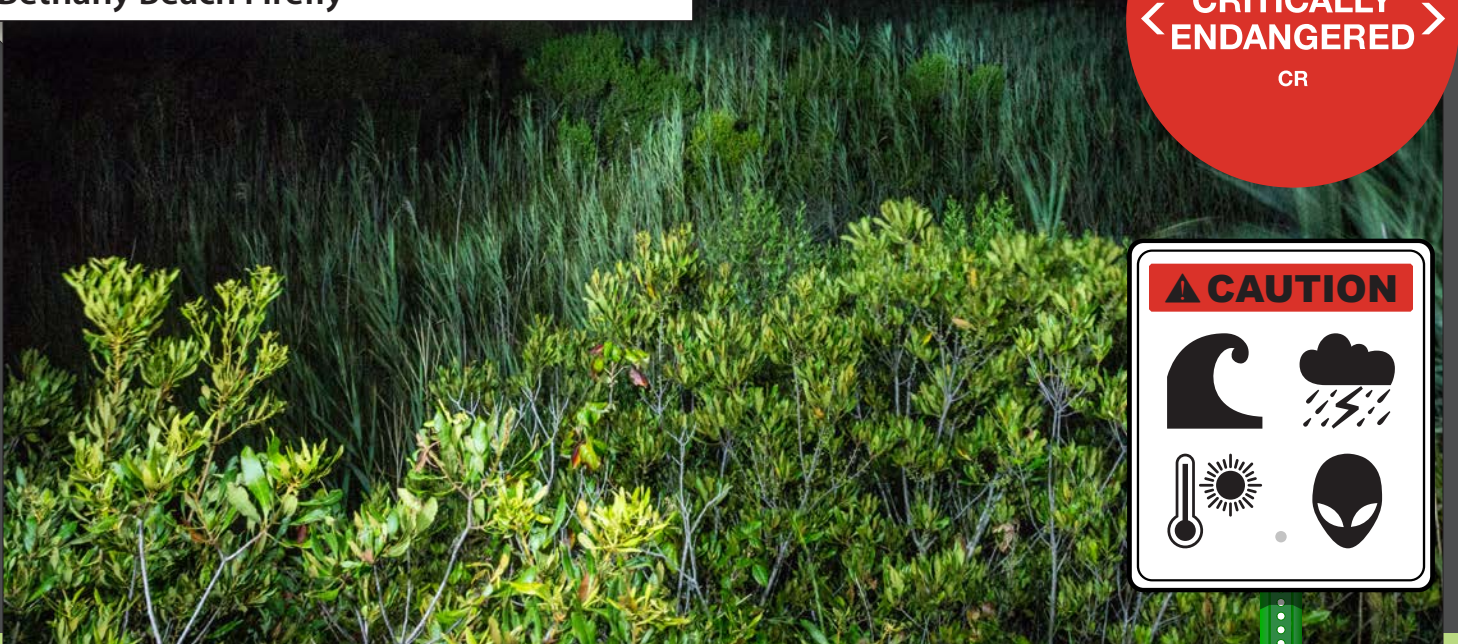


Figure 27—Invasive plants taking over sites like this one surveyed by the U.S. Fish and Wildlife Service & Delaware Division of Fish and Wildlife may be contributing to the species' decline [above];. (Photo: Kayt Jonsson, USFWS / flickr.)

Flash Pattern & Activity Period

Adults of this species are active after dark from late June to July or August, when males emit a distinctive bright green double flash about every five seconds.

	0	1	2	3	4	5	6	Seconds
♂	█	█					█	→ Long double-flash over two seconds, repeated at five second intervals
♀	▨	▨	▨	▨	▨	▨	▨	→ Female response unknown*

* Due to the aggressive mimicry utilized by some "femme fatale" firefly species—some of which have been documented using multiple flash-pattern responses—it has been difficult to determine which flash-patterns are used to attract mates or, alternately, to lure in unsuspecting prey males from other firefly species.

Photuris cinctipennis
Belted Firefly



< ENDANGERED >

EN



Figure 28—This species has been found in moist lowland areas of hardwood forests such as this wooded riparian area in Cedarville State Forest, Maryland [above]; belted firefly male [below]. (Photos: F. Delventhal / Flickr [above]; James E. Lloyd / University of Florida [below].)

Conservation Status

- » IUCN: EN
- » NS: G1G2; S4 (DE), SNR (MD)
- » SGCN: Delaware
- » US ESA: Not listed

Distribution

USA—Delaware, Maryland



11–12 mm



Description

The belted firefly has a very small range in Maryland and Delaware, and it appears to be quite rare. Despite extensive survey efforts and examination of museum collections, it has been documented from only five counties. The belted firefly is found in moist lowland areas in hardwood forests and isolated freshwater forested ephemeral wetlands of the mid-Atlantic coast.

This species is threatened by habitat loss and degradation due to urban development and sea-level rise.

Flash Pattern & Activity Period

Adults are active after dark in June and July and give off single yellow-green flashes at uncertain intervals.

	0	1	2	3	4	5	6	Seconds
♂								→ Very brief single flash repeated every four seconds
♀								→ Female response unknown*

* Due to the aggressive mimicry utilized by some “femme fatale” firefly species—some of which have been documented using multiple flash-pattern responses—it has been difficult to determine which flash-patterns are used to attract mates or, alternately, to lure in unsuspecting prey males from other firefly species.

Photuris flavicollis

Sky Island Firefly



< VULNERABLE >

VU



Figure 29—The Davis Mountains in Texas are one of the documented mountain ranges where sky island fireflies are found [above]; pinned *Photuris flavicollis* specimen [below]. (Photo: Cherie King / flickr [above]; Mike Quinn / BugGuide [below].)

Conservation Status

- » IUCN: VU
- » NS: G1G3; SH (NM), SNR (TX)
- » SGCN: None
- » US ESA: Not listed

Description

The sky island firefly, so named for the unique place in Texas that harbors this species, is associated with spring complexes in remote mountainous areas of western Texas. It has been documented in the Davis Mountains and surrounding mountain ranges. Over a hundred years ago, it was documented in Pecos, New Mexico, as well, so it may be more widespread than currently known.

The major threat to this species is habitat disturbance due to development for oil and gas extraction, light pollution, and drought. Surveys are needed to better understand this species' distribution. Its distinctive morphology and long breeding season may help with species ID, which is notoriously difficult for *Photuris* species.

Flash Pattern & Activity Period

Adults of this species are active from June to early August. Although the flash pattern has not been observed, males probably emit a continuous series of very short greenish-yellow flashes at least once a second, similar to other *Photuris* spp.

Distribution

USA—Texas, New Mexico



8.4–11.5 mm

Photuris forresti
Loopy Five Firefly



< VULNERABLE >

VU

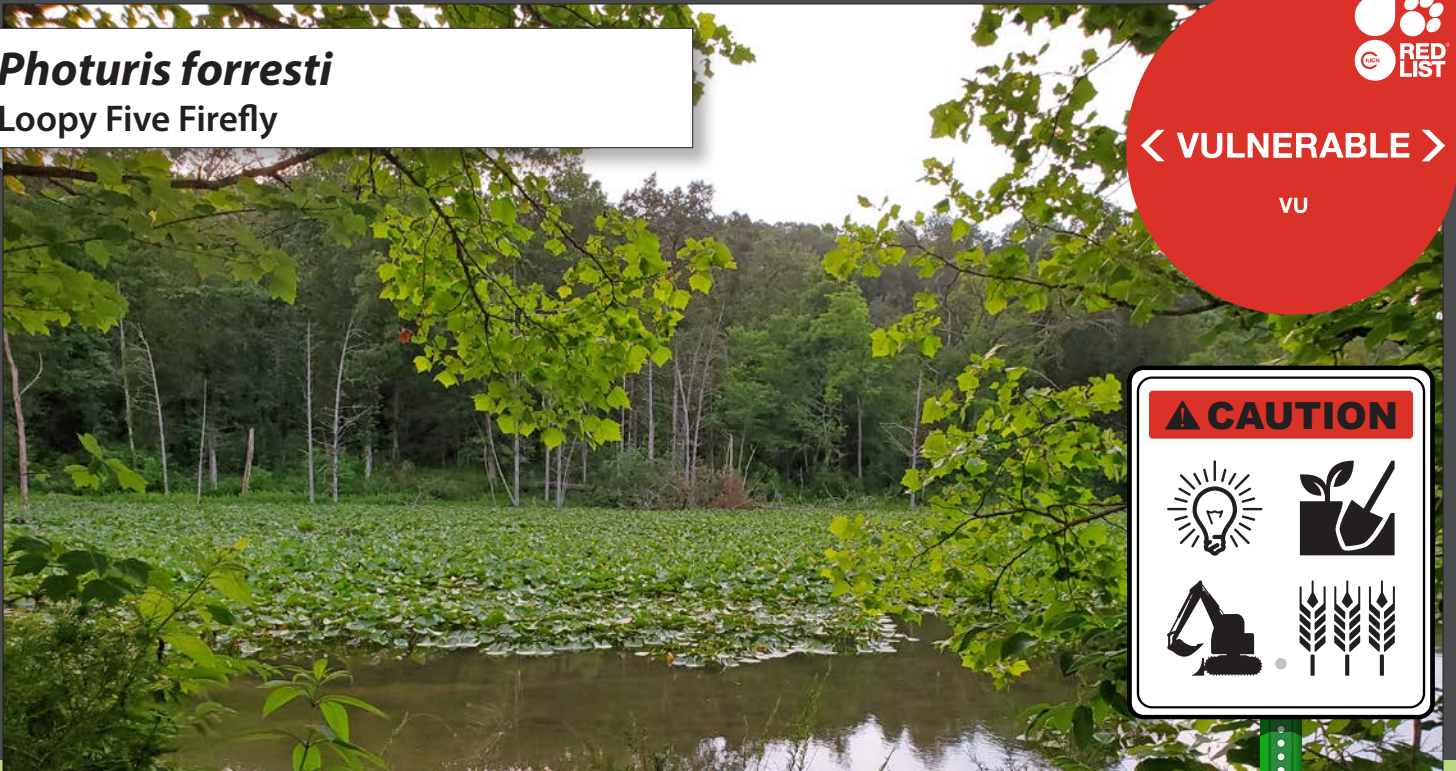


Figure 30—This marsh in Tennessee is one of three known sites where the loopy five firefly is found [above]; adult *Photuris forresti* [middle]; the characteristic five-spot flash pattern [below]. (Photos: Lynn Faust [above, middle]; Radim Schreiber [below].)

Conservation Status

- » IUCN: VU (tentative, unpublished)
- » NS: G1; SNR (GA, SC, TN)
- » SGCN: None
- » US ESA: Not listed

Distribution

USA—Georgia, South Carolina, Tennessee

11–12 mm



Description

The loopy five firefly occurs in marsh habitats and has thus far been documented at only three sites despite years of searching—in Tennessee, South Carolina, and Georgia. The original SC type locality has been destroyed, but the species was found at a site nearby.

Habitat loss is thus the main threat to this species; light pollution is also a threat. Habitat protection and increased survey efforts are critically needed to protect this firefly.

Flash Pattern & Activity Period

Adults are active from one hour after sunset until midnight in May and June. This species emits a series of erratic greenish-yellow pulses and prolonged flash trains in a five-spot looping pattern.



	0	1	2	3	4	5	6	Seconds
♂		■ ■ ■ ■ ■			■ ■ ■ ■ ■			→ Variable flash pattern, most common form is five or six rapid flashes leading into a train. Due to the rapid speed of the flashes, some may appear as a single long, modulated flash. See above. (Photo by.)
♀		■ ■ ■ ■ ■			■ ■ ■ ■ ■			→ Female response unknown*

* Due to the aggressive mimicry utilized by some “femme fatale” firefly species—some of which have been documented using multiple flash-pattern responses—it has been difficult to determine which flash-patterns are used to attract mates or, alternately, to lure in unsuspecting prey males from other firefly species.

Photuris mysticalampas
Mysterious Lantern Firefly



< **ENDANGERED** >

EN



Figure 31—An example of its Atlantic white cedar swamp habitat in Delaware [above]; pinned specimen. (Photos: Radim Schreiber [above]; Christopher M. Heckscher [below].)

Conservation Status

- » IUCN: EN
- » NS: G1G2; SNR (DE)
- » SGCN: Delaware
- » US ESA: Not listed

Distribution

USA—Delaware

Description

The mysterious lantern firefly is a habitat specialist associated with high-quality forested peatland floodplains, in areas where Atlantic white cedar is often codominant.

The primary threats to this species are habitat loss and degradation due to sea-level rise.



9–11 mm

Flash Pattern & Activity Period

Adults are active 30–40 minutes after sunset to past midnight from mid-June to late July and give off single yellowish-green flashes of medium luminosity typically every three to seven seconds.

	0	1	2	3	4	5	6	7	8	Seconds
♂	[Flash]			[Flash]				[Flash]		→ Short or long single flash repeated every three seconds in warmer weather
	[Flash]			[Flash]				[Flash]		
♂	[Flash]								[Flash]	→ Short or long single flash repeated less frequently in cooler weather, at up to seven-second intervals
	[Flash]								[Flash]	
♀	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	→ Female response unknown*

* Due to the aggressive mimicry utilized by some “femme fatale” firefly species—some of which have been documented using multiple flash-pattern responses—it has been difficult to determine which flash-patterns are used to attract mates or, alternately, to lure in unsuspecting prey males from other firefly species.

Photuris pensylvanica

Dot-Dash Firefly, Pennsylvania Firefly



< VULNERABLE >

VU



Figure 32—Ideal habitat for the dot-dash firefly in Allegheny National Forest, where the species has been recorded in the past [above]; illustration of the often-misidentified species. (Photo: Jim Mullhaupt / Flickr [above]; Jim White [below].)

Conservation Status

- » IUCN: VU
- » SGCN: Delaware
- » US ESA: Not listed
- » NS: G3?; S1S2 (DE), SNA (NY, WV), SNR (DC, MD, NJ, PA, RI), SU (VT)

Distribution

USA—Delaware, Maryland, New Jersey, New York, Pennsylvania



8–11 mm

Description

The dot-dash firefly is a habitat specialist associated with high quality tidal and non-tidal freshwater wetlands, such as shrub and forest acidic seepage swamps, emergent marshes, fens, fresh-water tide marshes, and floodplains.

The main threat to this species is habitat degradation due to sea-level rise, development, and invasion of the non-native plant, common reed (*Phragmites australis*), which can overtake this species' wetland habitats and make them uninhabitable for the firefly.

Flash Pattern & Activity Period

Adults are active in June and July an hour after sunset until midnight. Males emit a characteristic greenish dot-dash flash pattern, comprised of a quick flash followed by a long flash that lasts up to three seconds.

	0	1	2	3	4	5	6	Seconds
♂	[Green bar from 0 to 3]							→ The dot-dash flash is repeated at seven- to eight-second intervals
♀	[Diagonal lines from 0 to 7]							→ Female response unknown*

* Due to the aggressive mimicry utilized by some “femme fatale” firefly species—some of which have been documented using multiple flash-pattern responses—it has been difficult to determine which flash-patterns are used to attract mates or, alternately, to lure in unsuspecting prey males from other firefly species.

Photuris pyralomima
Pyralis-Mimicking *Photuris* Firefly



< **ENDANGERED** >

EN



Figure 33—This *Photuris* species can be found in old hayfields, overgrown pastures, or wet meadows, like the one pictured here in Delaware [above]; (Photo: TCDavis / Flickr.) There are no known photos or illustrations of this species.

Conservation Status

- » IUCN: EN
- » NS: G1?; S1S3 (DE), SH (NY)
- » SGCN: Delaware
- » US ESA: Not listed

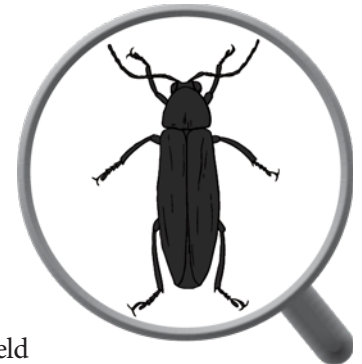
Distribution

USA—Delaware, New York (possibly extinct)

Description

This rare firefly is found in open habitats including moist meadows, hayfields, and fields with dense scrub-shrub vegetation, such as those that have been left to fallow.

Habitat loss and light pollution are the greatest threats to this species. If you own land with old field habitat within the range of this firefly, consider protecting and maintaining it by not mowing it, or mowing only once every one to two years.



13–14 mm

Flash Pattern & Activity Period

Adults are active in June after dark. Males emit a single, yellowish, half-second flash-glow every six seconds to attract females.

	0	1	2	3	4	5	6	Seconds
♂	■							→ Half-second flash repeated at six-second intervals (same as <i>Photinus pyralis</i>)
♀				?				→ Suspected female response pattern based on <i>Photinus pyralis</i>

Photuris salina
Salt Marsh Firefly



NEAR THREATENED
NT



Figure 34—Woodland Beach Wildlife Management Area in Kent County, Delaware, one of the few known locations where the species is still found [above]; adult *P. salina* perched on a blade of grass [below]. (Photos: Lee Cannon / flickr [above]; Radim Schreiber [below].)

Conservation Status

- » IUCN: NT
- » NS: G3; S3 (DE), SNA (VA), SNR (MD, NJ)
- » SGCN: Delaware
- » US ESA: Not listed

Distribution

USA—Delaware, Maryland, New Jersey, Virginia



11 mm

Description

The salt marsh firefly is restricted to tidal marsh habitats along the mid-Atlantic coast from New Jersey to Virginia.

The primary threat to this species is habitat loss and degradation due to sea-level rise and storm surge associated with climate change, pesticide use, urban development, and the spread of the invasive plant, common reed (*Phragmites australis*), which can overtake this species' marshy habitat and make it uninhabitable for fireflies. Some of the localities in Delaware may be extirpated due to these threats.

Flash Pattern & Activity Period

Adults are active May–July after dark. Males emit a single yellowish flash about once per second, sometimes in near synchrony with conspecific males, while flying just above the vegetation that lines the salt marshes in which they fly.

	0	1	2	3	4	5	6	Seconds
♂	Flash	Flash	Flash	Flash	Flash	Flash	Flash	→ Short single flash repeated once per second
♀								→ Female response unknown*

* Due to the aggressive mimicry utilized by some “femme fatale” firefly species—some of which have been documented using multiple flash-pattern responses—it has been difficult to determine which flash-patterns are used to attract mates or, alternately, to lure in unsuspecting prey males from other firefly species.

Photuris walldoxeyi
Cypress Firefly, Wall Doxey's Firefly



< VULNERABLE >

VU



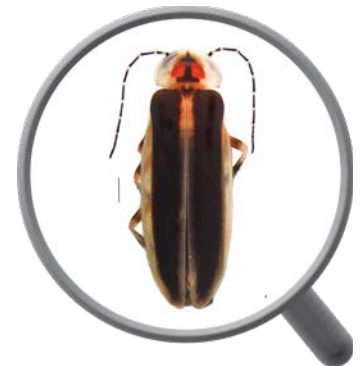
Figure 35—An example of this species' cypress swamp habitat in Mississippi [above]; a pinned specimen [below]. (Photos: Visit Mississippi / Flickr [above]; Luiz Silveira [below].)

Conservation Status

- » IUCN: VU
- » NS: G2G3; SNR (IL, MS, TN), SU (IN)
- » SGCN: None
- » US ESA: Not listed

Distribution

USA—Illinois, Indiana, Mississippi, Tennessee



11.9–12.6 mm

Description

As its name suggests, the cypress firefly is a habitat specialist associated with cypress swamps, although it is also found in tupelo gum swamps.

The main threats to this species are habitat loss and degradation and light pollution.

Flash Pattern & Activity Period

Adults are active mid-May to mid-June after dark (45 minutes after sunset). This species has a unique courtship flash pattern consisting of four to nine bright pulsing green-yellow flashes, followed by a prolonged one-second glow.

	0	1	2	3	4	5	6	7	Seconds
♂	●	●	●	●	○	○	○	○	→ Highly complex and variable with four to nine flashes followed by a one-second "train" that is sometimes immediately followed by another double-flash + one-second train
♀	▨	▨	▨	▨	▨	▨	▨	▨	→ Female response is erratic, consisting of quick single, double, or triple flashes*

* Due to the aggressive mimicry utilized by some "femme fatale" firefly species—some of which have been documented using multiple flash-pattern responses—it has been difficult to determine which flash-patterns are used to attract mates or, alternately, to lure in unsuspecting prey males from other firefly species.

Pleotomodes needhami
Ant-Loving Scrub Firefly



< **ENDANGERED** >

EN



Figure 36—Pine scrub habitat in Florida [above]; close-up of two ant-loving pine scrub firefly larvae outside an ant nest [below]. (Photos: Judy Gallagher / Flickr [above]; James E. Lloyd / University of Florida [below])

Conservation Status

- » **IUCN:** EN (tentative, unpublished)
- » **SGCN:** Florida
- » **US ESA:** Not listed
- » **NS:** G1G2; S1S2 (FL)

Distribution

USA—Florida



Description

The ant-loving scrub firefly is an unusual, range-restricted species found in association with ants in xeric pine and oak scrub forests along the Mid-Florida Ridge region. Larvae, pupae, and adults of both sexes have been found within ant nests. It is unclear how these fireflies evade detection by the ants, if their dispersal is assisted by them, or if they are true ant obligates. Because of their primarily subterranean nature, very little is known about this species. Perhaps, unsurprisingly, it has not been documented from very many localities.

Threats to this species include habitat loss and degradation due to agricultural and residential development as well as light pollution from nearby towns.

Flash Pattern & Activity Period

Flightless adult females emerge from ant colonies after dark in mid-April, emitting a light for up to an hour to attract glowing males. Note: flash color has not been documented.

	0	1	2	3	4	5	6	Seconds
♂								→ Males glow in response to female signaling, continuing to glow until after mating
♀								→ Females will glow for up to one hour <u>or</u> until after mating

Pyractomena ecostata
Keel-Necked Firefly



< ENDANGERED >

EN



Figure 37—Keel-necked firefly tidal marsh habitat [above]; an adult male *Pyractomena ecostata* [below]. (Photos: Andy Atzert / Flickr [above]; Oliver Keller / BugGuide [below].)

Conservation Status

- » IUCN: EN
- » NS: G3; SNR (AL, DE, FL, NJ)
- » SGCN: Delaware
- » US ESA: Not listed

Distribution

USA—Alabama, Delaware, Florida, New Jersey

Description

This firefly has a disjunct distribution, with populations in Alabama, Florida, Delaware, and New Jersey. It is a habitat specialist associated with brackish tidal marshes and wet pastures.

Habitat loss and degradation due to sea-level rise, development, the spread of invasive plants, and artificial light at night are the main threats to this species.



11.5–16 mm

Flash Pattern & Activity Period

Adults are active after dark from April through September (depending on the latitude). Males emit bright, yellow, explosive courtship signals, about a second in duration, every eight seconds or so.

	0	1	2	3	4	5	6	7	8	9	Seconds
♂											→ One-second flashes repeated at eight-second intervals
♀											→ Female response unknown*

* Due to the aggressive mimicry utilized by some “femme fatale” firefly species—some of which have been documented using multiple flash-pattern responses—it has been difficult to determine which flash-patterns are used to attract mates or, alternately, to lure in unsuspecting prey males from other firefly species.

Pyractomena vexillaria
Amber Comet Firefly



< **ENDANGERED** >

EN



Figure 38—This species' habitat along the Devil's River in Val Verde County, Texas [above]; a pinned specimen [bottom]. (Photos: Ben Pfeiffer [above]; Mike Quinn / BugGuide [below].)

Conservation Status

- » **IUCN:** EN (tentative, unpublished)
- » **SGCN:** None
- » **NS:** G1; SNR (TX)
- » **US ESA:** Not listed

Distribution

USA—Texas; MEX—Tabasco

9.6–13 mm



Description

The amber comet firefly has been reported from several different habitat types: over a marsh in Tabasco, Mexico; in mixed semi-arid cenizo and guajillo brushland with limestone river basins in Texas; and in the Texas Hill Country where the dominant vegetation is oak and cedar brush. This species has not been found in Texas since 1940, despite concerted survey effort, and much of the known range of this species in Mexico has been converted to sugarcane plantations and cattle pasture. Surveys are critically needed to determine if the species remains extant.

Threats to this species are not well documented but likely include light pollution and habitat degradation due to agricultural and urban development.

Flash Pattern & Activity Period

Adults are active after dark from May–August. This species displays an initial explosive amber flash, followed by quick one second upward-trailing flashes.

	0	1	2	3	4	5	6	Seconds
♂								→ Bright burst followed by a trailing flash at one-second intervals
♀								→ Female response unknown*

* Due to the aggressive mimicry utilized by some "femme fatale" firefly species—some of which have been documented using multiple flash-pattern responses—it has been difficult to determine which flash-patterns are used to attract mates or, alternately, to lure in unsuspecting prey males from other firefly species.

Appendix C

Species of Conservation Concern by US State and Canadian Province

This reference guide, arranged by state and province, includes **threatened** species (Critically Endangered [CEN], Endangered [EN], and Vulnerable [VU]), Near Threatened (NT) species, and Data Deficient (DD) species that are documented in the listed state or province and are suspected to be of high conservation concern. Red List categories are provided. The purpose of this list is to enable wildlife agencies, land managers, and conservationists to prioritize species for state- or province-level conservation efforts, protection, and legislation. Users should keep in mind that distribution lists are dynamic, constantly evolving as new information is uncovered.

For a full list of species and their distributions, regardless of Red List category, see [Appendix A](#). Note: if a state or province is not listed, then there are no threatened species known from that state/province at this time.

United States

Alabama

- [DD] *Pyractomena angustata*
- [DD] *Pyractomena dispersa*
- [EN] *Pyractomena ecostata*
- [DD] *Pyractomena floridana*
- [DD] *Pyractomena lucifera*
- [DD] *Pyractomena marginalis*

Arizona

- [VU] *Bicellonycha wickershamorum*
- [EN] *Bicellonycha w. ssp. piceum*
- [VU] *Bicellonycha w. ssp. wickershamorum*
- [DD] *Ellychnia bivulnerus*
- [DD] *Microphotus fragilis*
- [DD] *Paraphausis eximius*
- [VU] *Photinus knulli*
- [DD] *Prolutacea pulsator*
- [DD] *Pyractomena dispersa*



Photinus knulli

—AZ

Scott Cylwik

Arkansas

- <DD> *Photinus granulatus*
- <DD> *Photinus punctulatus*
- <DD> *Pyractomena dispersa*
- <DD> *Pyractomena marginalis*

Colorado

- <DD> *Pyractomena dispersa*

Connecticut

- <DD> *Photuris potomaca*
- <DD> *Pyractomena dispersa*
- <DD> *Pyractomena marginalis*
- <DD> *Pyractomena sinuata*

Delaware

- <CR> *Photuris bethaniensis*
- <EN> *Photuris cinctipennis*
- <EN> *Photuris mysticalampas*
- <VU> *Photuris pensylvanica*
- <EN> *Photuris pyralomima*
- <NT> *Photuris salina*
- <DD> *Pyractomena dispersa*
- <EN> *Pyractomena ecostata*
- <DD> *Pyractomena lucifera*

Florida

- <VU> *Lucidota luteicollis*
- <EN> *Micronaspis floridana*
- <EN> *Photinus acuminatus*
- <DD> *Photinus collustrans*
- <DD> *Photuris congener*
- <EN> *Pleotomodes needhami*
- <DD> *Pyractomena angustata*
- <DD> *Pyractomena barberi*
- <EN> *Pyractomena ecostata*
- <DD> *Pyractomena floridana*
- <DD> *Pyractomena lucifera*



Photuris bethaniensis

—DE

Kayt Jousson, USFWS / flickr



Pyractomena ecostata

—FL

Judy Gallagher / BugGuide

Georgia

- <EN> *Photinus acuminatus*
- <DD> *Photinus collustrans*
- <EN> *Photuris forresti*
- <DD> *Pyractomena angustata*
- <DD> *Pyractomena dispersa*
- <DD> *Pyractomena lucifera*
- <DD> *Pyractomena marginalis*

Idaho

- <DD> *Pyractomena dispersa*

Illinois

- <DD> *Photinus punctulatus*
- <VU> *Photuris walldoxeyi*
- <DD> *Pyractomena lucifera*
- <DD> *Pyractomena marginalis*

Indiana

- <VU> *Photuris walldoxeyi*
- <DD> *Pyractomena lucifera*

Iowa

- <DD> *Photinus punctulatus*

Kansas

- <DD> *Photinus granulatus*
- <DD> *Photinus punctulatus*

Kentucky

- <DD> *Photuris potomaca*
- <DD> *Pyractomena dispersa*

Louisiana

- <DD> *Pyractomena lucifera*

Maine

- <DD> *Pyractomena dispersa*
- <DD> *Pyractomena marginalis*

Maryland

- <CR> *Photuris bethaniensis*
- <EN> *Photuris cinctipennis*
- <VU> *Photuris pensylvanica*
- <DD> *Photuris potomaca*
- <NT> *Photuris salina*
- <DD> *Pyractomena dispersa*
- <DD> *Pyractomena lucifera*
- <DD> *Pyractomena marginalis*

Massachusetts

- <DD> *Pyractomena dispersa*
- <DD> *Pyractomena lucifera*
- <DD> *Pyractomena marginalis*

Michigan

- <DD> *Pyractomena dispersa*
- <DD> *Pyractomena lucifera*



Minnesota

- <DD> *Photuris caeruleascens*
- <DD> *Pyractomena lucifera*

Mississippi

- <EN> *Photinus acuminatus*
- <VU> *Photuris walldoxeyi*
- <DD> *Pyractomena angustata*
- <DD> *Pyractomena dispersa*
- <DD> *Pyractomena floridana*
- <DD> *Pyractomena lucifera*

Missouri

- <DD> *Photinus punctulatus*
- <DD> *Pyractomena dispersa*

Nebraska

- <DD> *Pyractomena sinuata*

New Hampshire

- <DD> *Pyractomena dispersa*
- <DD> *Pyractomena marginalis*

New Jersey

- <VU> *Photuris pensylvanica*
- <NT> *Photuris salina*
- <DD> *Pyractomena dispersa*
- <EN> *Pyractomena ecostata*
- <DD> *Pyractomena marginalis*

New Mexico

- <VU> *Photuris flavicollis*

New York

- <VU> *Photuris pensylvanica*
- <EN> *Photuris pyralomima*
- <DD> *Pyractomena dispersa*
- <DD> *Pyractomena lucifera*
- <DD> *Pyractomena marginalis*



Photuris sp.

—NM

Joe Cicero



Pyractomena sp. larva

—NY

John Beetham / flickr

North Carolina

- <EN> *Photinus acuminatus*
- <DD> *Pyractomena lucifera*
- <DD> *Pyractomena marginalis*

North Dakota

- <DD> *Pyractomena dispersa*
- <DD> *Pyractomena lucifera*
- <DD> *Pyractomena sinuata*

Ohio

- <EN> *Photinus acuminatus*
- <DD> *Photuris potomaca*
- <DD> *Pyractomena dispersa*
- <DD> *Pyractomena lucifera*
- <DD> *Pyractomena marginalis*

Oklahoma

- <NT> *Photinus dimissus*
- <DD> *Photinus granulatus*
- <DD> *Photinus punctulatus*
- <DD> *Pyractomena dispersa*
- <DD> *Pyractomena lucifera*
- <DD> *Pyractomena marginalis*

Pennsylvania

- <VU> *Photuris pennsylvanica*
- <DD> *Pyractomena dispersa*
- <DD> *Pyractomena lucifera*
- <DD> *Pyractomena marginalis*

South Carolina

- <EN> *Photuris forresti*
- <DD> *Pyractomena lucifera*
- <DD> *Pyractomena marginalis*

South Dakota

- <DD> *Pyractomena lucifera*

Tennessee

- <EN> *Photuris forresti*
- <VU> *Photuris walldoxeyi*
- <DD> *Pyractomena dispersa*
- <DD> *Pyractomena marginalis*

Texas

- <NT> *Photinus dimissus*
- <DD> *Photinus granulatus*
- <DD> *Photinus immaculatus*
- <DD> *Photinus punctulatus*
- <VU> *Photuris flavicollis*
- <DD> *Pyractomena lucifera*
- <DD> *Pyractomena marginalis*
- <EN> *Pyractomena vexillaria*

Utah

- <DD> *Pyractomena dispersa*



Vermont

- <DD> *Pyractomena dispersa*
- <DD> *Pyractomena sinuata*

Virginia

- <DD> *Photuris potomaca*
- <DD> *Pyractomena dispersa*
- <DD> *Pyractomena lucifera*
- <DD> *Pyractomena marginalis*

Washington

- <DD> *Pyractomena dispersa*

West Virginia

- <DD> *Photuris potomaca*

Wisconsin

- <DD> *Photuris aurolucens*
- <DD> *Photuris caeruleascens*
- <DD> *Pyractomena lucifera*

Canada

Alberta

- <DD> *Pyractomena dispersa*

Manitoba

- <DD> *Pyractomena dispersa*

Ontario

- <DD> *Pyractomena lucifera*

Quebec

- <DD> *Pyractomena lucifera*

Saskatchewan

- <DD> *Pyractomena dispersa*



Pyractomena sp.

-ON

Ian K. Barker / BugGuide



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